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NATURAL RESOURCES

OF THE

UNITED STATES.

BY

J. HARRIS PATTON.

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DR. LOUIS R. KLEMM

1885

THE

NATURAL RESOURCES

OF THE

UNITED STATES.

BY

J. HARRIS PATTON, M. A.,

Author of the "Concise History of the American People."

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PREFACE.

THIS Primer is designed to give the people of the United States a concise account of the Resources that Nature has bestowed upon their own land. These include coal and metals of various kinds; a fertile soil, which a copious rainfall and a favorable climate render capable of producing abundant crops; means of promoting domestic trade by navigable rivers; and an extensive coast-line, with fine harbors to facilitate commerce with foreign lands.

It is not surprising that so many Americans of the intelligent class seem to be unaware of the immensity of these Resources, as their attention has not been directed to them in their manifold forms.

From the *nature* of the subjects treated of, the information given becomes of interest to every citizen, and is not intended for one class of persons only—such as students who are about to finish their school or college education. Such being the case, care has been taken to combine two objects: the one that, if required, this Primer can be used as a class-book, and for that reason questions for the pupils' use have been added; the other, to con-

struct the work in a form suited also to the general reader, and to avoid as much as possible the usual formality of the mere text-book.

It is hoped the information here given will be specially valuable to American youth who are about to enter upon the active duties of life, as well as to those already thus engaged. In order to appreciate his own country properly, the citizen should be familiar with all the advantages it may possess.

The following works, among many others, have been consulted: Blodget, "Climatology"; Professor M. F. Maury, "Physical Geography of the Sea"; Professor A. Guyot, "Physical Geography"; Daddow and Bannan, "Coal, Iron, and Oil"; James Macfarlane, "Coal Regions of America"; Professor J. Le Conte, "Geology"; Professor Whitney, "Metals of the United States"; "The American Cyclopædia"; and P. L. Simmonds, "Commercial Products of the Sea."

J. H. P.

New York, *March*, 1879.

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PRIMER

OF THE

NATURAL RESOURCES OF THE UNITED STATES.

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1. If a spectator were stationed sufficiently high in the atmosphere directly over the Isthmus of Darien, and looked toward the north, east of north, and northwest, the great expanse of North America would appear to him in shape somewhat like an expanded fan; he himself being directly over the handle, while the widest portion of the fan would extend from the eastern point of Labrador to the western point of Alaska. He would see, in a northeasterly direction, and almost parallel to the Atlantic coast, the Alleghany range of mountains, which, taking their rise from the lowlands running back from the north shore of the Gulf of Mexico, extend in that direction, apparently throwing out and forward spurs, such as the Catskills and the Adirondacks, until these highlands jut out on the St. Lawrence in Canada. To the east of this northern portion he would see the subordinate range of the Green Mountains, and still farther to the northeast comes

within his view a group of isolated mountains, tossed in a bunch, without apparent connection with the others; these are the White Mountains of New Hampshire; they loom up higher than their neighbors.

Almost directly north he would see the great valley of the Mississippi, and, away over the divide of highland, down to the Arctic Ocean and Hudson's Bay. To the northwest would come within his view three ranges of mountains: the eastern, the Rocky—the backbone of the continent—running almost parallel with the Pacific coast, but much farther from it than the Alleghanies from the Atlantic, and much higher in their altitude. This range juts out on the Arctic Ocean. Parallel to this main range and west of it is another, the Sierra Nevada, in its northern portion known as the Cascades. Between these two ranges lies the Great Basin, having Salt Lake as its principal reservoir of water, but without an outlet. On the west side of the latter comes another series of mountains, known as the Coast Range, much lower in their altitude, but nearer the ocean and parallel with it.

2. Directly across this continent, from ocean to ocean and through its middle portion, the most desirable as to climate and soil, is the belt of territory occupied by the people of the United States.

COAST-LINE.

3. The length of the coast-line of North America, including indentations of gulfs, bays, and inlets,

is given by Professor Guyot at 27,700 miles, and by Professor Grove at 24,500 (Primer, Geog., p. 61). Europe, by the latter authority, has 19,500 miles of seacoast, of which 3,000 are within the arctic circle, or extreme north, and of little use for commerce, leaving available only 16,500 miles. As the total area of Europe is 3,700,000 square miles, this would give for each mile of coast about 224 square miles of surface. Europe is by far the most favored in this respect of any division of the Old World.

4. **Available Coast-Line.**—As we treat in this "Primer" only of the United States, we may take the coast-line, all of which is available, from the east border of Maine on the Atlantic to the mouth of the Rio Grande on the Gulf of Mexico, and from San Diego Bay to the Straits of Fuca on the Pacific —on both oceans including, as is usual, the indentations, such as bays, sounds, inlets, and estuaries; the south shore of the Great Lakes, and the shores of navigable rivers penetrating the country, all of which are available for internal commerce, and indirectly for external or foreign. We omit Alaska, both territory and coast-line, as of little avail for commercial purposes.

We find the coast-line, including indentations, etc., of the United States on both oceans about 18,000 miles, the shore-line of the Great Lakes at least 1,000, and the shore-line of the Mississippi and its tributaries 10,000 miles, though at certain seasons the navigable waters of these rivers have been estimated at 17,000 miles. Thus the entire

coast-line on the oceans, lakes, and rivers amounts to 29,000 miles, which, divided into the area of the United States, 3,014,459 square miles, excluding Alaska, gives about one mile of shore-line to each 104 square miles of surface.

5. **Advantages.**—We recognize the great advantage to a nation of having a seacoast indented with numerous bays, inlets, and estuaries. These afford harbors for shipping, and facilitate intercourse and commerce with outside countries, while long and navigable rivers, as with the United States, aid much in the more important item of internal commerce, and indirectly with foreign.

6. **The General Result.**—The past has shown that the most commercial nations of antiquity were those that inhabited countries whose coasts were thus indented, as were the coasts of Greece and Italy. Modern times show the same general result, inasmuch as the people thus situated are at the present time the most advanced in industrial pursuits and in commercial intercourse, as well as being on the higher plane of a Christianized civilization.

COAL.

7. In treating of the *resources* of the United States it is proper to commence with coal, as the minerals with which the country abounds would be of little avail were it not for *coal* to aid in their extraction.

We are told that "coal is not a mechanical formation, nor is it a chemical compound; it is the production of vegetable matter that grew upon the

place where now the coal is found," and "among which were no sea-weeds, but plants that grew in air." We can have but little conception of the marvelous amount of vegetation that covered these portions of the surface of the earth during the period designated the "Carboniferous age" by geologists. At that period grew certain flags which were *fourteen inches* in diameter; similar species are found to-day, but they are only *one half inch* in thickness; certain kinds of mosses then grew to the height of *fifty feet* or more, and thick in proportion, which now, even in the tropics, grow not very tall; and similar ferns now found in our woods loomed up in that period *sixty* or more feet. When compared with this, how insignificant appears the amount of vegetation in the densest forests of to-day!

8. **Pressure and Time required.**—It has been estimated that a seam of coal *twenty* feet thick would require to form it a deposit, in the form of peat, of this vegetable matter *one hundred and twenty* feet thick. We may strive to imagine the pressure required to reduce this mass to twenty feet in thickness. It is also estimated that "it would require 7,400 years to produce a single coal-bed *three* feet thick"; and Professor Dana thinks that "hard wood would be reduced three fourths in weight and seven eighths in bulk to form ordinary bituminous coal. . . . The extraordinary growth or formation of coal in the anthracite regions is due to an excess of naphtha or petroleum, which resulted from heat due to volcanic influences; and the nature of the coal is also

due to the same causes" (D. and B., p. 276)—a heat not sufficient to consume the coal, but only to deprive it of its volatile elements.

FIG. 1.

FIG 2.

FIG. 3.

FIGS. 1, 2, 3.—COAL-FERNS: 1. Callipteris Sullivanti (after Lesquereux). 2. Pecopteris Strongii (after Lesquereux). 3. Alethopteris Massilonis (after Lesquereux).

9. **The Identification.**—The almost perfect identity of these various plants, in some respects, with those of the present time, is ascertained from their remains imbedded in the coal or in the slates or shales above, or the clay beneath it. Here are found the images of the leaves of plants, branches, and twigs, showing their relationship by their construction; even the most delicate fibers of the leaf, when not clear to the naked eye, come out distinctly under the microscope. Especially are these remains found in the slates above the seam, when the fiber has not been perfectly transformed into coal; and in the impervious clay or fossil soil, which served as the bed of the morass where the plants and trees grew and shed their leaves, which in due time were converted into coal. In this clay are frequently found the remains of stumps and roots and even trunks of trees that have not been transformed into coal, but only into slates or shales, owing to the influence of the presence of sand and clay, or mud. "Certainly this vegetable matter must have been covered with water, as soon as it was formed, in order to be preserved from the rapid decomposition which always takes place in the open air"; and the "coal was thus formed by the accumulation of carbon and bitumen from an excessive growth of vegetation," when the climate was uniformly very warm and moist. The peat-bogs of to-day are but incipient coal-beds; all that is wanted are time and certain conditions to convert them into coal.

10. **Coal first bituminous.**—In some bitu-

minous coals these minute remains of leaves and fibers are sometimes found sufficiently distinct to indicate their origin, but in the anthracite, owing to heat and pressure, nearly every trace of the original material has disappeared. It is evident from its constituents that all coal was at first bituminous in character, and that the anthracite resulted from the combination of heat and pressure upon a certain portion of the great original coal-field.

11. **Characteristics.**—The structure of *cannel* coal consists of layers, easily split apart in one direction; it is usually compact, and contains a large per cent. of volatile matter, producing gas of great illuminating power.

12. **Horizontal Position of Strata.**—Geologists tell us this immense coal-field was at first level, and the strata of coals—for there are many such—were afterward upheaved by an internal force, and a portion of the seams was thrown to the surface. This exposed portion in the course of time, we know not how long, was wasted away by the action of the elements, and of course made a break in the continuity of the seam. That portion which remained deeper underground was preserved, and this coal we find to-day in the curved basins, especially in the anthracite regions; but in the bituminous the strata of coal are almost level, the dip being comparatively very little.

The resemblance of the various coal-seams is a convincing argument for this theory or statement, together with the similar strata of rocks, etc., con-

nected with them, which are pointed out as of the same uniform character. These wave-like seams appear like "wrinkles upon the face of Mother Earth," the causes of which geologists tell us; but that question is out of place to be noticed here.

THE EXTENT OF COAL.

13. When we compare the area of the coal-fields of the world, we notice the great disparity in relation to the quantity possessed by different countries. For instance, we learn from statistics that France has *one* square mile of available coal to every *two hundred* square miles of territory; Belgium *one* square mile of coal to every *twenty-two and a half* of territory; and Great Britain *one* square mile to *twenty* square miles of territory. France has a coal-field of 4,000 square miles, that is, where coal is found, but of these only 1,000 are workable, the seams being so thin; Belgium has 510 square miles of workable coal; the coal-field of England is given at about 12,000 square miles, that is, where coal is found, but the workable area is estimated to be 6,195 square miles by one authority, and by another at 5,000; yet Great Britain has more than half the coal-producing area of Europe. Professor Armstrong, as quoted by Le Conte, estimates that the whole workable coal of Great Britain will be exhausted in 110 years. (Le Conte, p. 340.)

14. **The Comparison.**—Some of the countries of Europe are destitute or nearly so of coal; and for its entire surface of 3,750,000 square miles of territory, it is estimated to have 10,000 square miles

of coal-producing area, or *one* in 375, while the United States with 3,000,000 square miles of territory has more than 200,000 square miles of known coal-producing area, or *one* to 15 of territory. This may be taken as the present estimate, but as new fields are discovered from time to time, the ratio, instead of being *one* in 15, will become much less. This estimate does not include the extensive coal-fields lying along the western edge of the Plains and the eastern base of the Rocky Mountains, and extending for hundreds of miles; nor the fields in the Great Basin and on the Pacific slope—these coals are known as lignites. The combined area of these separate fields is estimated at more than 100,000 square miles.

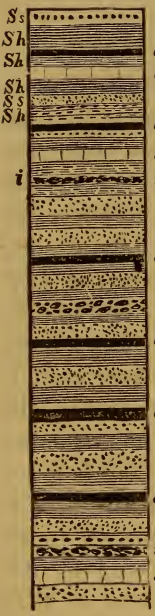

FIG. 4. — Ideal Section showing Alternation of Different Kinds of Strata. *Ss*, sandstone; *Sh*, shale; *l*, limestone; *i*, iron; and *c*, coal.

15. **Coal-Measures.**—The disparity is also great, both in respect to the thickness of the seams of coal and their availability in mining. The coal-measures, as geology informs us, consist of thick strata of sandstones, shales, or slates, ledges of limestone, and other rocks, also sometimes beds of iron-ore; and amid these strata are interspersed seams of coal of various thicknesses, some so thin as not to be available, and others sufficiently thick to be easily mined. Thus frequently, especially in the

United States, are found within easy reach the iron-ore, the coal to smelt it, and the limestone to flux it.

16. **The Dip.**—In England the thickness of the coal in the aggregate is estimated at *thirty-five* feet; but the seams are thin, ranging in size from only *twelve* inches to six feet, according to some authorities. The coal lies very low, and in order to mine it shafts must be sunk sometimes from 800 to 2,000 feet or more. The dip of the seams, for the most part, is quite great, and to free the mines of water is frequently very expensive. In the anthracite district of Pennsylvania, the available coal is fully 60 feet in thickness, and here the seams are few and of workable depth, one of which—"the Mammoth" or main seam—averages about 40 feet. Over the entire coal-field of the United States, as estimated by some writers on the subject, there is in the aggregate of workable seams an average thickness of 20 feet of coal. (D. and B., p. 320.)

17. **Facility of mining.**—One peculiarity of these fields of the Union is the ease with which the coal can be mined; because of its dip the most difficult being the anthracite of Pennsylvania, while in the bituminous regions the coal is found in workable seams from *three* to *eight* feet or more thick, running into the hillsides along the streams that have cut their way down through the coal-measures, or in almost horizontal seams found under the prairie, and easily reached by shafts of only a few hundred feet in depth. The seams in the hillsides are self-draining.

CLASSIFICATION OF COAL.

18. The coals of the United States may be divided into *four* general classes; the anthracite, the semi-bituminous, the bituminous, including cannel, and the lignite or brown coal. The anthracite is located farthest east; the semi-bituminous directly west of this; the latter marks the transition from the anthracite or *hard coal* to the bituminous or *soft coal*, found on the west slope and side of the Alleghanies, and thence westward till the lignite of the Rocky Mountains and Western Territories is reached.

19. **The Monopoly.**—Nature has given eastern Pennsylvania the monopoly of the anthracite coal, which can be said of no State in respect to the other coals just mentioned. This coal is hard to kindle, and burns with scarcely any flame, but is most valuable for its heating power, under the proper conditions of a draught. It contains from 85 to 95 per cent. carbon, with only a small amount of ash, and but little volatile matter. From the color of the ash this coal is frequently designated *white* ash or *red*; the latter owes its color to the presence of the oxide of iron. The white ash has generally about 95 per cent. of carbon, and the red from 85 to 90.

20. **Area and Richness.**—The area of the anthracite field has been surveyed, and amounts to 472 square miles, with an average thickness of 60 feet of available coal in different workable seams underlying the entire area. This would give 60,000

tons to the acre, and it is thought that with proper precaution in respect to the coal pillars, which sustain the roof of the mine, and greater care in preventing wastage, this amount might be increased one half. The aggregate thickness of the seams of coal in some portions of this field is more than 100 feet.

From twelve to thirteen million inhabitants derive their main supply of coal-fuel from this comparatively small area of anthracite, while the area of territory it naturally supplies is about 300,000 square miles.

21. **The Attritions.**—The entire anthracite region has spaces where the coal is not found, for geologists show that, owing to the upheaval of the original horizontal coal strata, they were curved, and the portions protruding above the surface were worn away by the attrition of the elements, while the remaining, underneath the surface, was left in narrow, trough-like basins curved up at the sides and ends.

Mr. James Macfarlane classifies this anthracite field as follows:

FIG. 5.—Section of Appalachian Coal-Field, Pennsylvania, showing Effects of Erosion on Gently-Undulating Strata (after Lesley).

1. Southern or Schuylkill basin .	area,	146	square miles.
2. Middle, Shamokin (50), Mahony (41), and Lehigh (37) . .	"	128	" "
3. Northern, Wyoming, and Lackawanna	"	198	" "
Total . .	"	472	" "

22. **The Basins.**—Of prominent places or business centers may be mentioned, in the first, Pottsville; in the second, Locustdale and Shamokin; and in the third, Scranton, Pittston, and Wilkesbarre. These separate basins are found on the head-streams of the rivers Schuylkill, Lehigh, and Susquehanna; the latter winds its way through the Wyoming Valley, but the coal-seams of that basin are below the bed of the river. These basins are irregular in shape, and contain coal in a number of seams, some of them of an astonishing thickness. Throughout this whole field, the main seam known

FIG. 6.—Nesquehoning Basins (after Daddow).

among the miners as the "Mammoth," so noted for its massive and solid benches of pure coal "without a streak of impurity," is from twelve to seventy feet thick, while the other seams are nearly all workable. "This is the most regular and reliable of all our coal-seams, the most economical to mine and operate, and from its size the most productive." (D.

and B., p. 251.) Indeed, owing to upheavals, the seams are much tilted, and therefore the mining operations here are carried on with much more difficulty and expense than in the bituminous fields, but this is compensated by the value of the coal, and by its being in great demand.

23. **Anthracite, where found.** — Anthracite coal, when compared with bituminous, exists in smaller areas. Besides in Pennsylvania, it is found in only one place in Virginia, and that in limited quantities. This coal is similar to the red-ash of the Schuylkill. In Rhode Island it is found, but it is small in quantity and of inferior quality; it is also found in New Mexico, some twenty miles from Santa Fé—this contains 88 per cent. of carbon, color jet black, and leaves a red ash—and on Queen Charlotte's Island, British Columbia. In Europe it is found in South Wales, in the south of Ireland, in France, in Saxony, and Russia; but in all these places in very limited quantities, and also inferior in quality.

SEMI-BITUMINOUS COAL.

24. The transition space from the anthracite to the bituminous fields of the west part of Pennsylvania is occupied by several basins of semi-bituminous coal, along the head-waters of the west branch of the Susquehanna, the Juniata, and the Alleghany Rivers. This form of coal is found only in the Alleghany range. As prominent among these basins may be mentioned the Broad Top coal-field, the area of which is about 80 square miles, and those

at Blossburg and at Tonawanda (M., p. 239). Of the same general character, semi-bituminous, is the coal found in the vicinity of Cumberland, Maryland. This field, being also on the eastern edge of the great Alleghany bituminous coal-field, is within the transition space just mentioned, though the anthracite lies north of it, and the bituminous coal comes round on its southern border. The aggregate area of the *three* basins comprising the Cumberland coal region amounts to about 550 square miles. This coal is much used for locomotives, and for generating steam on shipboard.

The semi-bituminous coal predominates for the greater part all along the extreme eastern line of this great coal-field. This edge appears to have been subjected, in a modified form, to the same influences of heat and pressure that prevailed in the region where pure anthracite is found. Thus far the influence exerted upon the industries of the land by means of the anthracite coal-fields has been exceedingly great.

BITUMINOUS COAL-FIELDS.

25. We now pass to the bituminous coal-fields, and notice first the isolated ones lying east of the Alleghanies. There are three coal-fields in eastern Virginia, all of limited dimensions: the Richmond, the Piedmont, and the Dan River. In the first, about thirteen miles west of Richmond, mines were opened in colonial times, but not worked to much extent; recently these mines have been operated to the depth of 130 to 700 feet.

There are several small basins near each other, the whole area estimated at about 185 square miles. These beds or seams vary in thickness, running from *four* to *forty* feet, and are irregular and broken, and liable to be "nipped out," as the miners say. The disposition of this bituminous coal in these troughs of granite is an interesting geological fact, nowhere else found on the continent. It is white ash and highly bituminous, but varies much in its quality in the different beds, some portions being quite impregnated with sulphur. Yet good coal can be obtained from these mines.

On the eastern margin of this basin is a bed of *natural* coke, as it is termed. It has all the qualities of coke, except the "cellular texture" of that article; this, it would seem, has been prevented by pressure when the volatile ingredients were driven off by heat. It retains all the carbon of the original coal, and makes an intense and steady heat, as it has about 81 per cent. of carbon. (M., pp. 505–508.)

The latter two fields mentioned are both small, and their seams thin, and worked only for a limited home consumption. A small coal-field lies in the Valley of Virginia, across which New River, the upper stream of the Kanawha, cuts its way toward the Ohio. This field, or rather trough, is not more than 1,000 feet wide, but miles in length, the seams from *two* to *four* feet in thickness. The coal is remarkably free from sulphur, but contains much earthy matter.

26. The coal-field in North Carolina, known as the Deep River, has an area of 60 to 100 square

miles. The seams are comparatively thin, but shafts have been sunk 360 feet, and a seam of *five* feet thick has been reached.

27. **Nearness of Ore-Beds, and Dryness of Coal.**—In some localities, as at Johnstown, Cambria County, Pennsylvania, are found the coal, the iron-ore, and the limestone, all imbedded in the same mountain, one above the other in horizontal beds and above water-level. The only transportation needed is the short distance from the mouth of these mines to the furnaces in blast.

The coals of the Alleghany field, both anthracite and bituminous, are remarkable for their dryness and their adaptability for all purposes for which great heat is required.

28. **Location of Coal and Extent.**—The bituminous portion of the Alleghany coal-field lies along the western slope of that range of mountains, through western Pennsylvania and across the Ohio River in its upper course for some distance; and in the same manner southwest along the slope, taking in West Virginia, eastern Kentucky, eastern Tennessee, northwest Georgia, and northern Alabama. Its widest portion is about 180 miles, from Cumberland, Maryland, to Newark, Ohio, tapering from this line toward the south, until in Alabama it is only thirty miles wide; it tapers also from the same line toward the north, but not nearly so much. The whole area is about 60,000 square miles.

29. **The Rivers and Valleys.**—From the crest of the mountains, and over their western water-shed, flow many streams, all taking a western or north-

western course, which leads them finally into the Ohio River. Evidently this water-shed of to-day was once a plain, which by internal force was tilted gently or raised on the southeast side, from the original position, so as to decline in a uniform manner toward the northwest. The Conemaugh, the Youghiogheny, the Cheat, the Monongahela, the New River, and its prolongation the Kanawha, the Cumberland, and the Tennessee, with their numerous tributaries, cut their way across this inclined plane, making deep valleys down through the coal-measures, bringing the coal itself to light as it is now seen cropping out on the hillsides. It took innumerable ages to accomplish all this, and to open the way for easy mining, and saving millions on millions of expense in shafts and machinery and extra labor. In this process the vast amount of coal that once occupied the space of the present valleys, these rivers scooped out and carried away. Yet, as far as we know, there remains coal sufficient for the use of man through all coming time, while he has been compensated, if need be, for the loss, in the greater facilities of mining thus obtained, and in the means afforded by these rivers in the transportation of the coal to where it is wanted, and in the beautiful and fertile valleys of the whole region, enriched by these various streams. The irregular hilltops that remain are the representatives, more or less, of the surface of the primitive plain. These hills also preserve the original strata of coal-seams, and the corresponding strata of rocks and earth. The coal of this field, for the most part, is similar

in its characteristics, yet we find some differences. It is estimated to have workable coal-seams in the aggregate from 20 to 30 feet thick, the lower seams being generally the thickest and the purest.

30. **The Pittsburg Seam.**—As in the anthracite coal one main seam was noticed—the "Mammoth"—so in the bituminous field is found a main seam also, known as the "Pittsburg"; thus named, as in the hills surrounding that city, and for a hundred or two miles distant from it, extends this particular seam. This coal enters immensely into the varied industries carried on in that busy city. This seam is not less than *eight* feet in thickness, and toward the southeast from Pittsburg it gradually increases in depth till at Connellsville, sixty miles distant, it is from nine to *eleven* feet, and still farther, at Cumberland, Maryland, it reaches from twelve to *fourteen* feet. Upon the whole, this seam is wonderful in the regularity of its formation; it occupies in area about 20,000 square miles, and extends into West Virginia, Ohio, and Maryland. The coal of this seam is not surpassed in certain valuable properties; it is everywhere used for obtaining gas, and much of it is taken to the Eastern cities as well as to the Western for that purpose. Just east of Pittsburg, on the Pennsylvania Central Railroad, is the most important gas-coal-mining region in the Union. This coal is virtually free from sulphur, and yields from 40 to 45 cubic feet of gas to each *ten* pounds of coal. It is also valuable for smelting purposes in the form of coke.

31. **The Many Seams.**—The fertile hills that

line the valleys in this field have two or three other seams of coal besides the main or Pittsburg; one of these is sometimes cannel, as found on the upper Monongahela. As a rule this main seam preserves a nearly horizontal position, hence it is easily mined, and is likewise self-drained. This is noticeable on the banks of the Monongahela, where the main seam on the upper portion rises gradually from the water's edge, till in the course of some 50 miles it crops out 200 feet above the river, then it drops almost to the water's edge at Brownsville; then rising again evenly, it crops out sixty miles distant in the hills near Pittsburg, 300 feet above the water's edge. It may be remarked that the descent of the river makes this dip appear greater than it really is. At Pittsburg is found another seam of coal, 100 to 150 feet below the surface.

32. **The Statement.**—Sir Charles Lyell ("Elements of Geology," p. 392), after expressing his astonishment at the magnitude of this seam of coal, says, "Horizontal galleries may be driven everywhere at very little expense, and so worked as to drain themselves, while the cars laden with coal, and attached to each other, glide down on a railway, so as to deliver their burden into barges moored to the river's bank." He might have added that in most cases the laden car in passing down draws up an empty one to the mouth of the mine. No doubt Sir Charles's amazement was increased as he compared the ease with which this coal was mined with the difficulties of mining coal in his native land.

33. **The Remarkable Change.**—This seam

changes its character somewhat in the course of fifty miles southeast of Pittsburg at Connellsville, on the Youghiogheny River, near the western base of the mountains. Here it becomes free from sulphur and phosphorus, and also increases from nine to *eleven* feet in thickness, and acquires properties that make the best coke known for smelting raw iron-ore in blast-furnaces. It is equally famed for its excellences for foundry purposes in melting pig-iron, and in converting it into steel by the Bessemer process; it is transported and used much in mixture with the Western bituminous coals.

34. **Varieties of Coal.**—A very important section of this coal-field is in West Virginia; perhaps in proportion to its size the richest State in the Union in coal, iron, oil, and salt. New River, the upper course of the Kanawha, the main river of the State, rises in North Carolina, and in cutting its way through the mountains forms a gorge, having on either hand cliffs rising from 800 to 1,200 feet, thus grading a way for the Chesapeake and Ohio Railroad, uniting the two waters as the name indicates. Along this river are found some isolated and small basins of anthracite coal, but in disturbed or irregular strata (M., p. 267). Several varieties of coal are found in this State, the common bituminous all along the Kanawha, four seams of which are found above its bed, three of which are workable, while on Coal River, a branch coming from the north, crop out seams of common coal, and also an extensive seam of cannel—the famed Peytona seam—of excellent quality. In Ritchie County is a "vein

of asphaltum *four and a half* feet thick, more than 3,000 feet long, and of unknown depth. It fills a great fissure, which breaks through the rocks, nearly perpendicular, and outcrops on the surface." This deposit is in connection with petroleum.

35. **Coals, Block and Cannel.**—The area of productive coal in the State of Ohio is about 7,000 square miles. It belongs to the northwest portion of the Alleghany coal-field. The seams are remarkable for their regularity and gentle inclination. The varieties of coal consist of laminated "block"—the same in kind as that found at Brazil, Indiana—cannel, and the ordinary bituminous—all, as far as known, in the eastern portion of the State. What is called the Mahony Valley seam of coal is deemed of very fine quality, as it is good for open burning and also for smelting iron-ores from the same valley. The cannel coal is found excellent for generating steam in locomotives, and for making gas.

36. **Kentucky and Tennessee.**—The coal-field of eastern Kentucky occupies an area of about 10,000 square miles. It is in trust for the future, as at present, for the want of roads, it is comparatively inaccessible, and has not been much developed.

The coal area of East Tennessee is about 3,700 square miles in extent. It belongs to the high table-land known as Cumberland Mountain. This high plateau is from 900 to 1,200 feet above the valley of East Tennessee, and 2,000 above the ocean. This valley has all the materials at hand for making iron—the ore, coal, and limestone. Geologically

speaking, this is the most interesting section of the Alleghany or (here) Cumberland range.

37. **Coal and Iron-Ore near each other.**— Alabama has three distinct coal-fields in her northern portion. The principal, the Black Warrior, thus named from the river that flows over it, has an area of 5,000 square miles. The seams of this field range in thickness from *eighteen* inches to *four and a half* feet. The coal is of medium quality. The other two fields comprise only a few hundred square miles of area. These coal-deposits are surrounded by beds of iron-ore, principally *red hematite*, especially that of *Red* Mountain, some twenty-five miles in length. Here is another striking instance where iron-ore, coal, and limestone are in a native state near each other. The coal-field of northwestern Georgia is quite limited in extent, being in area only a few hundred square miles.

CENTRAL COAL-FIELD.

38. We now pass to the Central coal-field, in the aggregate amounting to more than 50,000 square

FIG. 7.—Illinois Coal-Field (after Daddow).

miles, taking in all that is found in the States of Illinois and Indiana on the north side of the Ohio,

and a portion of western Kentucky on the south side. It is divided about as follows: Illinois, 40,000; Indiana, 7,700; and Kentucky, 3,888 square miles. The Mississippi River separates this field from its counterpart in Iowa and Missouri. These formed, no doubt, at one period, one and the same continuous field. The coal of these prairie States is reached by sinking shafts from 200 to 400 feet deep. The coals of Kentucky and Illinois are of the common bituminous character.

39. **A Coal remarkably pure.**—The "block-coal" of Indiana deserves a more special notice. It is thus named because of its peculiar construction, as it is crossed at right angles by joint-seams, that greatly aid the miner in handling it. It comes out of the bed in cubes about *three* feet long by *half* as wide and thick. The structure is laminated or in layers, splitting easily in one direction, but not in the other. This coal is remarkably free from both sulphur and phosphorus (M., p. 392). "The blocks retain their shape until burned to ash in such a manner as will permit the ready passage of the blast and flame through the entire mass of fuel, ore, and flux. . . . For manufacturing pig-iron, this coal is not surpassed by any in the country. The ashes left by a burning mass are as white and flocculent as those of hickory-wood," and, though subjected to the strongest draught, it does not clinker. The area of this "block"-coal field thus far discovered is about 450 square miles.

40. **The Ores, the Furnaces.**—At Brazil, once an obscure station on the Cincinnati and Terre Haute

Railroad, where, a few years since, this coal was accidentally discovered, have been established several blast-furnaces. The ores are brought to the coal-mines from Lake Superior, and from Iron Mountain, in Missouri, and are mixed in the furnace. There are no less than *eleven* seams, great and small, in this field of coal, which in the aggregate amount to *twenty-eight* feet; one of these, a common bituminous coking coal, is *seven* feet thick.

41. **Where else Block-Coal.**—In Illinois is also found a seam of the iron-smelting block-coal. It is near the Mississippi, southeast of St. Louis, and just across the river from the famous Iron Mountain. This coal is also found in several other places in southwestern Illinois. It has the valuable properties of the Indiana block-coal. The coal of this large Central field is deemed, in the main, inferior to the bituminous coal of the Alleghany field, the exception being the block-coal just mentioned.

42. **The Number of Seams.**—The coal area of western Kentucky has seams of valuable cannel ranging in thickness from *four* to *six* feet. Sometimes as many as three seams of different kinds of coal, each from *five* to *six* feet in thickness, appear, one above another, cropping out on the same hillside, within the space of 125 feet.

43. **Characteristics of this Coal.**—The coal-field of Iowa is but the extension of the Central, as has just been noticed, and the coal has the same general characteristics, is under the prairie, and mined in the same manner. The area, as far as now ascertained, is about 16,000 square miles.

44. **Singular Coal-Deposits.**—Missouri has an area of 26,887 square miles of coal-seams, principally in the eastern portion of the State. This has the same qualities, essentially, as that of the coal of Illinois. Some of this coal is reached by shafts only *thirty* or *forty* feet deep.

In this State are found a number of singular local deposits of coal, which are of remarkable thickness, but not following the laws governing the strata in other places; nor are they in connection with the rocks where coal is usually found, but, geologically speaking, "in the older rocks below the level of the regular seams of coal." The same may be said of nearly all the coal of Iowa. This isolated coal region, so abnormal in its characteristics, lies near the mouth of the Osage River, and on both sides of the Missouri. The deposits are both of the bituminous and cannel. The seams are limited in extent, but are of extraordinary thickness, ranging from *twenty* to *forty* feet. The structure of this cannel-coal is peculiar, and its lightness is such that it will float on water before it becomes saturated. In its structure, fracture, and luster, it has the appearance intermediate between the ordinary cannel-coal and the dull varieties of asphaltum. All the cannel-coal thus far discovered in the State seems to belong to these singular deposits.

45. **Coal less valuable; the Specimens.**—Michigan has an isolated coal-field of about 6,700 square miles. The coal is not as valuable as some others, because of its containing so much sulphur. It is remarkable for the many beautiful specimens

preserved in its shales of terrestrial vegetation, such as fern-leaves.

Nebraska has about 3,000 square miles of coal thus far discovered. The seams are comparatively thin, and not very available for use.

46. **Coal-Seams and Limestone; the Transition.**—Kansas has a coal area of 22,256 square miles, which lies in almost a horizontal plane, so that at any point within the field the coal can be reached by sinking shafts in the prairie. The uniformity of the thickness of the seams is remarkable (M., p. 479). Geologists tell us that "the lowest geological formation known in Kansas is the upper portion of the coal-measures." The upper seams of coal are only from *ten* to *twenty-eight* inches thick, while the deeper range from *five* to nearly *seven* feet. The latter furnish good coal, and are easily worked. In these coal-measures are found also many strata of limestone. The finest portion of the coal-field of Kansas borders on the Indian Territory, and no doubt it extends within that beautiful region. The coal of eastern Kansas is bituminous in character, but in the western portion a transition commences, and the coal gradually partakes of the properties of the lignite variety, which is represented as "a lighter coal, containing more gaseous matter and less carbon."

47. **Semi-bituminous.**—Arkansas has a coal-field of 10,000 square miles. Two seams have been found, the lower one alone being available. Here is also found a seam of semi-bituminous, even richer in carbon than similar seams in Pennsylvania.

The seam in one place is from three and a half to four feet in thickness, in another four and a half. This coal contains 82½ per cent. carbon.

48. **Underlaid with Coal.**—Texas has a surveyed bituminous coal-field from 4,000 to 5,000 square miles in extent, but no doubt much more will be discovered hereafter, as a large portion of the State is supposed to be underlaid with coal. This field has been opened along the Brazos River; the seam varies in thickness from two to four feet. Lignite coal has also been found in this State.

LIGNITE.

49. As has been said, the transition from the bituminous to the "oxygenated class of coals," or lignite, begins in western Kansas, and the line from that point runs quite regularly north and south, so that we find this class of coal in Colorado and on the upper Missouri, and indeed all along the eastern base of the Rocky Mountains, even to the far north, on the head-waters of the Saskatchewan in the British Possessions.

50. **Ingredients of Lignite.**—This coal contains an unusual amount of water, and can not be used to advantage in foundries, as it will not produce sufficient heat to melt the metal. The composition of lignite would seem to be of wood—the remains of trees—as transported by rivers or heaped up in various ways, as if in morasses, where the trees grew and fell. The fossil leaves found in lignite indicate that these trees were similar to those of the present day; beneath the coal, in the hard

clay and rocky strata, occur innumerable impressions of leaves, much like those of our common forest-trees, but belonging to species long extinct, showing that far back in "the geological past" these now treeless regions were covered with a dense forest. It is destitute of the fern-leaves so common in the bituminous coal-measures.

51. **Beds of Charred Wood.**—These coal-beds (for they are not seams in the sense of those found in the bituminous fields) are of great thickness, sometimes even *twenty-six* or *twenty-seven* feet, as are the beds on the eastern border of Utah. For the most part, these coals are remarkably pure, like charred wood or soft charcoal. At Golden City, Colorado, is a bed of lignite from *ten* to *fourteen* feet thick, which is mined by a shaft. There are many such mines opened and operated in the State—such as near Boulder—while others are being discovered from time to time. This coal will not furnish sufficient heat, and the machine-shops of the Pacific Railway are supplied with coal from the semi-bituminous fields of Pennsylvania.

52. **Extent of Lignite Mines.**—At Cheyenne, Wyoming Territory, near the east foot of the Black Hills, by the side of the railway, is sunk a shaft *seventy* feet down to a coal-bed *seven* feet thick. A goodly portion of the coal mined here is used in the locomotives, as it makes a fine flame and generates steam rapidly.

Lignite-coal mines, for nearly 500 miles west of Cheyenne, have been found along the route of the Pacific Railway. It is estimated that the lignite-

coal field along the eastern base of the Rocky Mountains, and between them and the Sierra Nevada, amounts to 50,000 square miles within the United States, and it extends far into the British Possessions. In truth, time may show it to be much greater than it is now estimated.

COAL ON THE PACIFIC SLOPE.

53. The coal found on the Pacific slope is of the lignite or tertiary variety; it exists in many places along the slope, and also near the coast. These coals are more or less soft and friable, and contain more than usual of moisture, therefore giving less heat than the ordinary bituminous kind; it is quite liable to waste in the handling. The woody fiber of this coal is so impregnated with bitumen that it burns with the peculiar smoke and flame of that substance.

54. **The Region supplied.**—At Mount Diablo, twenty-eight miles nearly east of San Francisco, are a large number of coal-mines, which are extensively worked, the beds ranging in thickness from *two and a half* to *four* feet. From these mines the whole region round about is supplied; it is also used on the coast and river steamers, and for stationary engines and other purposes. The lowest bed is worked by means of a perpendicular shaft 700 feet deep.

55. **Coal free from Sulphur.**—Farther north, in the valley of Coos River, in southern Oregon, are extensive mines of coal of superior quality. The seam is *four and a half* feet thick of workable coal, which is free from sulphur, and not liable to

spontaneous combustion, as so many of these lignites are; it is also free from an unpleasant odor when burning. These coal seams or beds are nearly horizontal, and are found in the hillsides, so that the mining is easy. They extend over a large space in the vicinity, but vary much in thickness—the maximum reaching *nine* feet. The coal has the defect of all lignites, not giving out much heat, compared with the bituminous of the East, but burning with a bright flashing flame. (M., p. 569.)

56. **The other Coal-Mines; the Flora.**—Still farther north are the Seattle coal-mines, in Washington Territory. The port of Seattle is the finest on Puget Sound, but the mines are nine miles distant. These have *five* seams of coal, ranging in thickness from *four* to *twelve* feet. In the extreme northwest of the Territory are the coal-mines, on Bellingham Bay. "There are *nine* coal-seams, making in the aggregate 110 feet, the seams ranging in thickness from *five* to *twenty* feet. . . . The flora of Bellingham Bay is remarkably like that of the lignite beds of the upper Missouri, the genera being all represented on that river, and some of the species identical." (Professor Newberry.) This coal produces a large amount of slag and refuse when burning.

57. **The Region underlaid.**—Geologists "suppose there is an extensive region underlaid with coal on the west side of the Cascade Range, extending from Willamette Valley to Bellingham Bay. The lowest seam is reported to be *sixteen* feet in thickness." There is also almost a continuous out-

crop of coal along the coast-hills from Cape Flattery to Admiralty Inlet, in Washington Territory.

Coal is found at various places along the coast of Alaska. It partakes of the general character of the coal at Bellingham Bay and Vancouver's Island. Anthracite has been reported as having been found at several places in Alaska.

COAL-FIELDS OF THE DOMINION.

58. It may not be out of place to notice briefly the coal-fields of the Dominion of Canada. Nova Scotia, or the eastern provinces, have about 2,500 square miles of available coal, though the area in which it is found is estimated from 5,000 to 10,000; but the seams are so thin that for the most part they are unavailable. "Out of *seventy-eight* seams at Pictou, the thickest bed contains only *three* feet *eight* inches of pure coal," and consequently it is mined with difficulty. The amount of sulphur in these coals materially impairs their value. Most of them are fatty, or highly bituminous, and produce gas, and, when distilled, oil quite abundantly.

59. **Immense Beds of Lignite.**—In British Columbia coal is found in abundance on Vancouver's Island; it partakes of the nature of that found at Bellingham Bay. The mines are worked extensively. In northwestern Ontario immense beds of lignite extend along the eastern base of the Rocky Mountains, but how far is not definitely known. This vast coal-field covers all the head-fountains of the Saskatchewan, and also extends along the sources of Lake Athabasca. Another

similar coal-field stretches along the west side of the Mackenzie River, it is said, to the sixtieth degree of latitude. This lignite is found in beds from *two* to *eight* feet in thickness.

IRON-ORES.

60. We come now to speak of the minerals of the United States—first of iron, as the most important in its influence upon the welfare of man. It may be stated that iron-ore is found in almost every section of the country, sometimes in small, isolated beds, apparently without any connection with each other, and sometimes in extensive veins amid the rocks in the mountains, or between layers of limestone, or in connection with coal-measures. These ores are often of far different properties, as the iron happens to be combined with various foreign substances. "Iron-ores occur in so many different forms, and under so many chemical combinations, that no one theory of formation can cover the coincidents and conditions with which they are found" (D. and B., p. 561). From some of the mines the ore is easily obtained, while in others it is found between ledges of rocks, so that it is extracted with great difficulty, the mine or vein running indefinitely among the rocks.

61. **The Incidental Combinations.**—It may be remarked that almost universally these ores are found in connection with ledges of limestone and strata of coal, both these combined being essential in separating the impurities from the iron as found in ores. The ores are often designated by these

incidental combinations as red, black, or yellow oxides, magnetic, specular, hematite, and many others—too many, in truth, to enumerate in this Primer.

62. **Iron-Ore found in Many Places.**—Iron-ore—generally magnetic—is found in all the New England States, but in limited quantities, and in so many places that it would be tedious to mention them. The fuel necessary to smelt these ores may not now be convenient of access—thus they are in trust for the future. These isolated beds of ore often produce the very best quality of iron.

63. **Ore producing Good Iron.**—In New York State, on Lake Champlain, and in the adjoining mountains—the Adirondacks—exist extensive beds of ore, which produce iron among the best in quality. It has hitherto been smelted by means of charcoal obtained from the neighboring forests. This State has also a remarkable deposit of iron-ore at Stirling Mountain, Orange County, the quality of which partakes of the nature of the famous Swedish ore mined at Danemore, in that country; and geology finds it imbedded in the same class of rocks. This bed is said to be nearly exhausted.

64. **Rich Ores, easily mined.**—The State of New Jersey is peculiarly rich in magnetic ores, which seem to be practically unlimited in their extent, and, as they are within easy reach of the anthracite-coal field of Pennsylvania, and have an abundance of limestone near by, they are deemed very valuable. These ores are easily mined; and the labor of transportation is comparatively light,

both for the ore and the fuel, so that this region, taken altogether, may be reckoned among the finest in the world for producing iron.

65. **The Mineral Wealth.** — Pennsylvania stands preëminent in her mineral products. To her immense coal-fields are to be added inexhaustible mines of iron-ore, and ledges of limestone without limit. We find ore in this State under almost every condition: amid the hard rocks in the mountains, and in the valleys along their base; and, still farther away from them, in the great limestone valley, the plowman occasionally runs against a lump of iron-ore.

66. **A Singular Deposit of Ore.**—In Lebanon County, of this State, is a singular deposit of iron-ore, inasmuch as it is somewhat mingled with that of copper. This is one of the most extensive beds, and perhaps the most interesting, in the State. The ore of this deposit differs in character and structure from that of the other ores of this limestone region, as it seems to be the result of a volcanic eruption, terminating between the limestone ledges of the valley.

67. **The Stretch of Iron-Ore Deposits.**—As we pass along this mountain-range toward the south, we find on both slopes—east and west side—more or less deposits of iron-ore, with the accompaniments of coal and limestone. On the east side is the long valley, under several names—Cumberland, Shenandoah, or Valley of Virginia, and Tennessee—extending from the Lehigh to the Chattahoochee, and on the west side a similar valley—

Ligonier in the northeast, and under different names —stretching from near the New York State line far into West Virginia. Throughout these are found more or less iron-ore deposits.

68. **The Wealth of Rich Ores.**—The great region of iron-ores in Virginia is in the limestones of the valley between the Blue Ridge and the main range, massive detached beds of ores—"magnetic, red oxides, and brown hematite"—in deposits never very deep, but in ridge and hill, or in hollows and crevices, amid the limestones.

A belt of iron-ores extends across the State in a northeast and southwest direction, and is known to be rich in the production of metal. This deposit is practically inexhaustible, and contains every variety of ore suitable for making iron and steel; in addition, the ores are easily mined, while an abundance of limestone is at hand for fluxing purposes. The specular and magnetic ores of this belt are said to "contain only a trace of sulphur, and are practically free from phosphorus." This extensive belt is known as the "James River" in the vicinity of Lynchburg, where the ores have been mined to some extent, and where their good properties have been tested.

69. **The Ore-Fields of this State and the Cumberland Mountains.**—Then comes western North Carolina, equally rich in having remarkable beds of ore—black oxide—which, when mined, looks like black sand, but has the best of reputations for producing good iron, in the common charcoal-furnace, at the rate of 70 per cent. of the raw

ore. These ores, it is hoped, will become accessible to the coal-field of the Kanawha by means of connections with the railway along the cliffs of New River.

The iron-ore field of the southern end of the Alleghanies, or Cumberland Mountains, shows many varieties of ores, and in sufficient abundance, it would seem, for all time. These ores of various kinds produce also iron of different qualities.

70. **The Great Deposit, and its Accompaniments.**—In passing into northern Alabama we have Red Mountain—an outspur of the Cumberland—*twenty-five* miles long by *four* or *five* wide, thus named from the tinge given its clay by the red iron-ore with which it greatly abounds. Here, within easy distance, are found the coal and the limestone for smelting this red ore.

There are also found detached deposits of iron-ore, both in Kentucky and Tennessee, west of the Alleghanies, and a very large deposit of iron-ore exists in eastern Ohio, in the Mahoning River Valley.

71. **The Comparison; the Revolution.**—The Alleghanies, in connection with their outspurs, stand preëminent in the world for their immense stores of iron and coal, and also for an abundance of limestone, so indispensable in smelting iron. What a contrast between the Alleghanies and the Alps, the latter comparatively so barren of minerals! Even when compared with the Andes, and our own Rocky Mountains and Sierra Nevada, how much more important to the world is their iron and coal, in their intrinsic value, than the gold and silver of the

three latter! The iron of the Alleghanies can do more to advance the true welfare and progress of mankind than the silver and gold of the world combined. In the almost infinite applications of our iron wealth we only give an earnest of what our position is likely to be in the industrial world of the future.

During the last few years a great revolution has been wrought, by the numerous improvements introduced, in extracting iron from the ore, and in modern appliances, by which this iron is easily refined and converted into steel. It would seem that for almost every purpose the more durable steel is superseding the old-fashioned iron, the former being so much more strong and lasting, and, for that reason, in the end, more useful and less expensive.

72. **The Iron Mountains.**—There are two singular deposits of iron-ore in Missouri. These are immense, and known as Iron Mountain and Pilot Knob. They are about *six* miles from each other, and nearly *seventy-five* miles southeast from St. Louis. These elevations are from 500 to 600 feet high, and are both filled with successive veins, or beds, of iron-ore. Iron Mountain is said to have the richest, it yielding 70 per cent. iron, while Pilot Knob yields 60, the characteristics of the ores being somewhat different. It is estimated that nearly one tenth of the bulk of these two mountains is pure ore.

73. **The Varieties of Rich Ores; the Result.**—Thus far we have seen the metallic ores more or less coexisting with coal and limestone. We now

come to an exception: neither coal nor limestone exists around Lake Superior, but iron-ores are found in untold quantities, and remarkable in the richness of their qualities. These ores apparently consist of all varieties—black and red oxides, specular and brown hematite. Well does this rich ore pay to be transported to the furnaces along the Great Lakes, to Pittsburg, to Brazil (Indiana), and other localities, to be mixed with ores from other mines. For science has shown the great advantage of blending in the furnace ores of different qualities, which must of necessity come from different localities, sometimes quite distant from each other. A great number of mines are worked around this lake, and the ores are transported to where there is fuel to smelt them.

74. **The Masses of Iron-Ore.**—Iron exists in detached beds in the east region of the Rocky Mountains. In Boulder County, Colorado, the summits and sides of some of the hills near where the coal-mines are found are partially covered with masses of brown iron-ore. We possess perhaps more than double the amount of the minerals, coal and iron, that is owned by all the other portions of the world combined.

GOLD AND SILVER.

75. We come now to treat of the resources of the United States in the precious metals, gold and silver; yet the world could dispense with them much easier than it could with coal and iron. There are two distinct gold-fields in the Union;

one belonging to the Alleghany range, the other to the Sierra Nevada and the Rocky Mountains; the former very limited in extent and product, when compared with the latter. The Alleghany field comprises small portions of the States of North and South Carolina, Georgia, and Virginia. The gold has never been obtained in great quantities from this field, but it is thought that, when more skill is acquired in extracting it, these deposits will be worked to advantage.

76. **Gold and Silver Mines.**—"The auriferous veins of California are parallel to each other and to the Sierra Nevadas, except a few smaller ones. . . . These fissures or veins seem to have been all produced at the same time, when the Sierra Nevadas were pushed up." (Le Conte, p. 201.) In California, on the western slope of the Sierra Nevada, are gold-mines—principally in the basins of the San Joaquin and Sacramento—while on their eastern slope are silver-mines, the richest known.

77. **The Discovery and Result.**—In 1848 gold was discovered by a laborer amid the gravel he was digging. The news spread rapidly over the country, and to foreign lands. Thousands upon thousands flocked to secure the treasure. In a few years the "placers," or "diggings," were exhausted. Then came the change, when mining and extracting gold became a regular industry. All along the western slope of the Sierra Nevada, through California up to Oregon, and across to the Coast Range, are mining districts in the ravines, and extending, amid the rocks, sometimes, to the very summits of

the mountains, wherever gold-bearing quartz is found.

78. **Mines, and Modes of Mining.**—This quartz is laboriously obtained from the veins, between walls of hard rock, by drilling and blasting, then brought to the stamp-mills, where it is crushed, and the gold extracted by the usual process, by the application of heat and quicksilver. The amount of gold-bearing quartz seems to be limited only by the size of the mountains in which it is found, as they are pervaded more or less by the veins or fissures. From year to year the mines, as they are worked, run deeper and deeper, and in proportion the expense of mining is increased, which is somewhat compensated by the greater scientific skill now employed in extracting the gold from the rock than in former times.

There is certainly room for improvement in this respect, and it is hoped ere long discoveries will greatly facilitate the process by which the precious metals are separated from the quartz in which they are imbedded in the vein. It would be tedious here to go into detail in describing the numerous mining districts that extend for hundreds of miles along the west side of the Sierra Nevada, as these districts are all very similar in character. They are all sufficiently rich—some more, some less—to encourage working them, yet it appears to cost as much labor to earn a dollar from gold-bearing quartz as it does from the ordinary industries of the land. Such is the order of Providence.

Gold is also found in Oregon, and in Washing-

ton Territory; but in the latter, especially, the mines have not been developed.

79. **Crushing-Mills; Eagle Mountain.**—East of these gold-fields are those of Idaho Territory, in which are many gold deposits that compare favorably in point of richness with any others in the land. The "placers" and gulch-mines have been exhausted, and the mining for gold has become a permanent industry. Crushing-mills are established, and improvements in machinery have been made from time to time to crush the quartz. Some of the lodes in Idaho contain both gold and silver quartz.

One singular and isolated deposit is known as War Eagle Mountain. It rises 2,000 feet above the valley, and is about five miles in diameter at the base. This is as famed for its extent and richness in gold- and silver-bearing quartz as the great mountain in Missouri for its iron-ore. These lodes contain about two parts of gold to seven of silver. They run down into the mountain almost perpendicularly, but grow wider as they descend.

80. **The Mining Industry.**—Colorado has extensive lodes of gold-bearing quartz. These run far down into the mountain amid the hard rocks. Here gold-mining has become an extensive industry, applying all the facilities afforded by machinery, since the placer mines, once so exceedingly rich, have become nearly exhausted. Leadville, a mountain town in this State, is likely to become a rival of Virginia City, Nevada, in the production of silver. The veins are found to be large, and the ore of a

high grade, and comparatively easy of access. The deposit is very extensive, and new discoveries are of frequent occurrence.

81. **Black Hills; Territories farther south.**—The Territories of Montana and Wyoming have both gold-fields, having the same general characteristics as those of Idaho. The Black Hills, on the eastern border of the latter, are now open to occupation, and appear to be quite rich in gulch or placer mines, and the indications are that the "Hills" have also lodes of gold-bearing quartz. The same may be said of the gold-fields of the Territories farther south, New Mexico and Arizona.

82. **Silver, where found; the Comstock.**—The State of Nevada stands preëminent in having the richest silver-mines in all this region. They lie on the eastern slope of the Sierra Nevada Mountains, and on the western side of the Great Basin. These mines produce also gold in combination with the silver—the former not nearly in so great proportion.

The most noted lode of silver-bearing quartz—the Comstock—is by far the richest ever discovered. The farther it has been opened, the richer it has become. It has been traced already two miles or more, is growing wider, and seems to extend indefinitely. The same may be said of the other lodes running almost parallel with it. These lodes run down into the mountain, how far none can tell. There are nearly one hundred separate companies working the "Comstock lode." Within these mines, or workings, is no intermission of labor; it goes on by relays, night and day—no Sabbath, no winter,

no summer—thousands of burners make this mysterious region as light as day.

83. **The Expense; the "Sutro Tunnel."**—As the mine becomes deeper, the expense of ventilation, pumping out the water, and raising the ore to the surface, increases more and more in the same proportion. To obviate these difficulties the "Sutro Tunnel" has been made. It enters the mountain about 2,000 feet below Virginia City, or the opening of the mines, and 3,500 feet below the top of Mount Davidson, on whose side stands the city. The tunnel, nearly five miles long, is to drain and ventilate the mines, and take out the ore on a level. From the tunnel will be extended branches and galleries in every direction the lodes may run. What will be the effect is yet unknown, but it is thought that by these means this immense deposit of silver-bearing quartz can now be all reached.

84. **Area of Gold and Silver Fields.**—The gold and silver fields of the United States occupy about 150,000 square miles. This resource of wealth has an extensive influence upon the commerce and civilization of the world, inasmuch as these precious metals are used as a medium of exchange between the nations. Their effect is felt to a large extent beyond the limits of our own country.

THE MINOR METALS.

85. The minor metals, such as platinum, zinc, nickel, and others, have thus far been found in the United States in limited quantities. Tin-ore has recently been discovered, however, in the Black

Hills of Dakota, and in available quantities for mining. The miners, not knowing the character of the black stone that troubled them so much in their mining for gold, threw it aside as worthless; but a miner from Cornwall, noticing the resemblance of the rejected stones to the tin-ore he had seen in England, tested them and obtained tin. The ore crops out in granitic rocks known to geologists as "greisen," and sometimes it is found in crystalline bunches inclosed in quartz and mica. The rocks in which it is found are particularly free from any mineral or impurity, such as sulphur or arsenic, that impairs the quality of the tin. The ore abounds in regular veins and in deposits of unusual extent and richness; is cleaner and purer than that obtained from the mines of Cornwall, being free from mixture with iron, lead, or copper pyrites. The area in which this tin-ore is found extends for a long distance on both sides of the Harney Peak Mountains, the crest of the Black Hills. The veins of tin-ore run downward as in Cornwall, where the mines are 2,500 feet in depth, but the Harney Peak deposits are so much above the ordinary level, though running downward, that the veins are reached by horizontal tunneling. "The heavy crystals of tin-ore separate easily from the mica and spar, and are obtained as 'black-tin,' ready for smelting, and yielding from the latter about 65 per cent of metallic tin." The mine known as the Etta appears to have the richest ore thus far discovered (1885).

Tin has been discovered in Massachusetts in one

or two places, and in New Hampshire, but not available for mining. *Zinc* is found in New Hampshire and in New York; but New Jersey is richer in this metal than any other State, and here only have the deposits been sufficiently valuable to warrant mining to much extent. There are a number of small deposits in Pennsylvania, and in connection with some of the Western lead-mines. *Nickel* has been found in small quantities in Connecticut, and also in Maryland. *Platinum* has been discovered in Idaho, but in connection with gold-mines. *Telluride* is also found in the vicinity of Boulder, in Colorado.

PETROLEUM.

86. Theories are at fault to account satisfactorily for the origin of petroleum. One contends that it is produced by a peculiar process of nature whereby bituminous coal has been subjected to a high temperature, similar to the distillation of coal by which the same kind of oil is obtained; another, that it is the result of a peculiar decomposition of certain organic substances. The writers on the subject seem to agree that this oil is the production of sea-plants under salt-water, as coal is the production of terrestrial vegetation under fresh water, and some ascribe these rock-oils to the organic remains which lie entombed in the rocks. Geologists speak of the "oil-bearing strata" and of their characteristics, but they have apparently not as clear data as in the case of coal to determine its origin. We are told of "the maceration of sea-weeds or marine plants, that the tissue or fiber of them has been

destroyed and pure bitumen preserved by accumulation in cavities; . . . that bitumen and petroleum are formed from the more perishable cellular plants and animals in the presence of salt-water"; and reference is made to the fact that petroleum "is often associated with salt," as in West Virginia. "The origin of bitumen and petroleum is clearly connected with that of coal." (Le Conte, p. 376.)

87. **Theories and Proofs.**—One theory is that the bituminous coal was first formed, and afterward, by some peculiar alchemy of nature, the bitumen was extracted under the form of gas, light oils, heavy oils, and finally bitumen itself, under the hard form of asphaltum. The *second* theory is that these oils were formed directly from certain organic remains in connection with marine plants, or at least with some unexplained connection with salt.

In proof of the *first* theory is instanced the process by which we can distill bituminous or cannel coal, and obtain petroleum; and of the *second* that this bitumen or oil is found often in connection with salt. The latter may be accidental, while the coal would seem not to be; but it may be asked, Where are to be found the *débris* of the seams of coal thus distilled in Nature's great laboratory?

88. **Classification of Oils and the Reservoirs.**—There are three classes of oils—the upper, middle, and lower: the first are heavier and thicker, and most valuable, as their volatile elements have escaped through the soil, they being near the surface; the middle oils found at a depth of from 300 to 600 feet are the most abundant; at this depth they

exist as naphtha; at a still greater depth, more than 1,000 feet, the oils exist as gas. (D. and B., p. 656.)

The strata of rocks in which oil deposits exist are horizontal or nearly so, and in their long, irregular, and sometimes narrow crevices, the oil is found in reservoirs like pockets, in which ores are often deposited. These reservoirs are not thought to

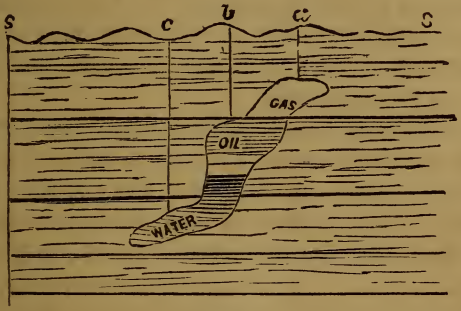

FIG. 9.

be very deep, as the pump in time usually exhausts them. When the auger strikes the water first, or the oil, if they are in connection with gas, the latter's expansion frequently forces them to the surface; but if the auger penetrates the gas first, the explosion and rush to the surface are often terrific in violence. When this pressure of the gas is exhausted, in order to obtain the oil, the pumps are brought into requisition. The water, the oil, and the gas arrange themselves in the order of their relative specific gravities, as indicated in the figure.

89. **The Oil Districts; their Area.**—The most productive region thus far discovered for oil is that of northwestern Pennsylvania, where immense quantities have been obtained in the vicinity of the Alleghany River, and on its branches. West Virginia is also remarkably rich in this product, especially in the valley of the Little Kanawha. Oil is found in Kentucky, in Michigan, and in northeastern Ohio, and likewise in California, "all the way from Los Angeles to Cape Mendocino." In Canada, near Lake St. Clair, is quite a large area from which oil is obtained, having the general properties of that found in Pennsylvania.

Throughout these regions there are very numerous localities where oil may be found, and wells as rich perhaps as any that have hitherto been worked. The finding of rich reservoirs of oil is quite uncertain, yet when found the flow is frequently very copious. Geology tells us that the "oil-bearing strata of rocks" in the United States cover an area of about 200,000 square miles. There would seem, by this statement, to be held in reserve a wealth of oil practically unlimited; and, as in the past, so in the future, we may expect it to be found just at the time it is most needed.

LEAD.

90. Lead is found in many portions of the Union, often occurring in veins and in connection with other metals, especially copper and silver, and sometimes between strata of limestone. This metal is found in limited quantities along the Atlantic

slope in the vicinity of the highlands from Maine to North Carolina. But all these deposits are very small compared with the lead-fields, as they may be termed, of the Mississippi Valley. One of these, having an area of about 4,800 square miles, occupies a portion of three States—Wisconsin, Illinois, and Iowa. Galena, a city in the second-named State, is the most important locality of this mining region; here would seem to be lead sufficient to supply the country for an indefinite time; copper is also found to some extent in connection with this deposit of lead-ore. The ore is so abundant that it was first discovered imbedded in the soil, and so lightly that plowmen frequently turned lumps of it up in the fields. The surface ore was soon exhausted; and the veins are now traced and drilled far underground, and the ore, when loosened by blasting with gunpowder, is brought to the surface by the miners.

Directly south of these are the mines of Missouri and Arkansas. Those in the latter State have not been much developed. In the former, the most important center is the lead-mining village of Grandley, in the southwest portion of the State, on the Atlantic and Pacific Railway. Here is a vast deposit of lead-ore, but to reach it shafts are sunk quite deep; the great richness of the ore fully compensates for this extra expense of shafts, and for freeing the mines of water.

COPPER.

91. This metal is often found in a pure state,

and also as ore combined with foreign substances, such as sulphur or oxygen. In North Carolina copper is found more abundantly than in any other State east of the Mississippi; though it is scattered in very limited quantities along the eastern slope of the Alleghanies. It is also found to some extent in California, and in some of the Western Territories, especially in Idaho.

The great copper-field of the Union, however, belongs to the State of Michigan, in that portion known as the Upper Peninsula, bordering on Lake Superior. Here are found vast masses of native or pure copper; yet this, from its very pureness, is more difficult to obtain in quantities that can be handled, than that which is smelted from the ordinary ore. First the mass of pure copper must be dislodged by tremendous blasts of gunpowder, or some other explosive—but copper does not break to pieces by the explosion; it only *tears*—and then it must be cut away by means of long chisels.

92. **Isle Royale Mines.**—Lake Superior, among its numerous islands, has a very remarkable one—Isle Royale—belonging to the United States. It is *forty-five* miles long, and on an average *twelve* miles wide; for the most part rising out of the water in a bluff 300 feet high. It has some long and narrow inlets, worn deep into this rocky wall; these inlets serve for harbors. This island is exceedingly rich in copper, found here sometimes almost pure, and in masses often weighing a hundred tons. Many of these mines are very extensively worked, some extending into the bluff more

than half a mile. The copper of this State would seem to be almost inexhaustible. The north shore of Lake Superior, in Canada, is also very rich in copper as well as in iron ore.

MERCURY OR QUICKSILVER.

93. We have noticed, in treating of the deposits of iron, how often the coal and limestone were found near by to smelt the ore, and thus in California, near her gold and silver mines, we see another striking instance of the same principle in the economy that the Creator has instituted. We allude to the quicksilver-mines known as the New Almaden; these are situated on the inside of the Coast Hills, about twelve miles southeast of San José. This metal is as necessary in obtaining the precious metal from the gold-bearing quartz as coal and limestone for obtaining iron from the ore. Quicksilver is used under certain conditions for extracting the gold, as it has for this metal such an affinity as to seize it with the grip of the miser; and as death can only make the latter let go his grasp, so intense heat can only make the quicksilver give up its gold.

94. **The Mine and the Ore prepared.** — These mines are the richest in the world. This vein of ore runs far down into the earth, and is reached by a perpendicular shaft; the vein is followed thousands of feet by the miners, who have opened galleries in all directions. The ore is brought up the shaft in buckets of large size, in

which, in primitive style, the miners also pass up and down.

This peculiar ore or cinnabar is a reddish sulphate of mercury or quicksilver, having the dull-red color of bricks. The ore is crushed and prepared in such a manner as to be molded into blocks; these are arranged, with spaces between, in ovens or kilns, and then are subjected to intense heat, which in the form of flame passes between the blocks, and decomposes the ore, causing the quicksilver to exude from the earthy matter in the form of vapor. This vapor passes into a chamber designed for the purpose, and when cooling condenses on its walls; then trickles down the sides into channels, which convey it into a reservoir, from which it is drawn off into iron flasks—glass could not bear the weight. The quicksilver is then ready for market. Mercury is also necessary in extracting silver from the ore, as it has a strong affinity for that metal.

The production of quicksilver is quite limited; in addition to a number of places in California, there are indications of its existence in several places within the gold and silver fields of the United States; otherwise it is found in workable quantities only in Peru, Spain, and Austria.

GRAPHITE OR PLUMBAGO.

95. This substance is one of the forms of carbon, sometimes containing iron; originally called black-lead, because it made a dark mark, somewhat like lead. It is found, but in very limited

quantities, at Sturbridge, North Brookfield, and Hinsdale, Massachusetts, and in some other places, as at Brandon, Vermont, Ridgebury, Connecticut, and in Wake County, North Carolina. There is an unusually large mine of graphite in the vicinity of Ticonderoga, New York; the only one in the Union thus far discovered that warrants mining to much extent, unless it may be the Eureka mine in Sonora, California, as the ore or substance is so likely, as the miners say, "to run out." One of the most noted mines in the Old World is in Cumberlandshire, England, said to be now about exhausted, as it has supplied nearly all the world for more than a hundred years; there is also one in Ceylon, of coarse graphite alone, and an extensive deposit in northeastern Siberia.

96. **The Two Kinds of Plumbago.**—The mine at Ticonderoga is unusually rich in having the two kinds—the *coarse* for making crucibles and the *fine* for making pencils. These are separated by a thin partition of rock; the fine being of smaller quantity, and in isolated places called pockets by the miners. The plumbago is taken out from between these walls of gneiss rocks, to remove which requires extensive blasting and great labor. In this mine the vein runs down into the earth at an angle of *forty-five* degrees, and has been already followed some hundreds of feet.

The graphite found here is remarkable for its superior properties; it is said no other mine in the world produces so pure an article in its natural state. This material is used extensively for other

purposes than making crucibles and pencils; such as for *dry* lubrication, as in the action of the piano

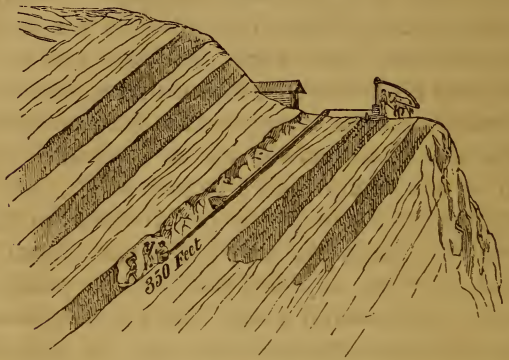

FIG. 10.—Section of Graphite Mine at Ticonderoga, New York.

and the organ, or in any wooden surfaces that in action move over each other.

We have thus in abundance the materials for making graphite or lead pencils, as nature has also given to certain swamps of Florida the monopoly of the world in producing the peculiarly fine-grained cedar used in the manufacture of all grades of fine pencils, both in this country and in Europe. The United States have the largest establishment in the world for making pencils.

SLATE.

97. The principal quarries of slate in the Union are in the States of Pennsylvania, New York, and Vermont. The first furnishes a slate of fine texture,

dark gray, and of other colors, and adapted for use in schools, and for many other purposes.

The slate-quarries of New York border on those of Vermont, and the slates of both partake of the same general characteristics, being of the finest quality. The purposes to which slate has been applied within recent years are almost innumerable: such as for sinks, tanks, roofing, beds for billiard-tables, etc. The most interesting process, however, to which it is subjected is when it is enameled in imitation of variegated marble, to be used as articles of furniture. It is thus made very beautiful, and so finished as never to be affected by temperature or climate; but even under ordinary circumstances it preserves its freshness and brilliancy of color. Vermont has a quarry of a soft, drab-colored slate, much used for slate and other pencils. These are made by machinery, and turned out, shaped, and sharpened, by millions.

GRANITE, BROWN AND DRAB SANDSTONE, AND MARBLE.

98. The finest granite in the United States is found in vast quantities in Massachusetts and New Hampshire; and there are also quarries of fair granite, but of limited extent, in Maine, Rhode Island, and Virginia, while the coarser varieties are found in a great number of localities. The most valuable quarries in Massachusetts are at Quincy and on Cape Ann. That obtained here has been used much by the National Government for public buildings, and for docks in the navy-yards. Great

numbers of the municipal and other public buildings in the cities on the Atlantic slope have been constructed of this material, as it has been quite accessible by water.

The Granite State is specially rich in this durable stone, and, though it is farther inland, the stone is sent from the interior of the State by railway to the cities, to be used in buildings. The stones are taken from the quarry, and dressed by machinery and by hand; each block, large or small, jointed and fitted to the proper shape and dimension, and ready to be laid in the wall, according to the directions of the architect of the building; then, the sharp edges having been protected by wooden clamps, these finished blocks are sent to the point of destination. This plan of leaving the *débris* at the quarry saves an immense amount of extra expense in transportation. Granite and marble furnish nearly all the ornaments in the cemeteries of the country.

99. **Sandstone for Buildings; how dressed.**—Vast deposits of brown sandstone are in the valley of the Connecticut, and in the State of New Jersey; from these the neighboring cities derive their "brown-stone fronts." The best quality of this stone is durable when exposed to the atmosphere, and is unchanging in color. The same facilities as in the case of granite are brought into requisition for dressing this stone at the quarries. There are also large deposits of coarse marble, suitable for building purposes, in Westchester County, New York. Much of it is used in the Metropolis.

100. **A Gray Limestone and a Drab Sandstone.**—At Lockport, in the same State, is an abundance of building-stone—a peculiar gray limestone, which is very easily worked when taken from the quarry, but when exposed to the air becomes hard and does not change its color. It is also dressed by machinery, saws of a peculiar kind being used, by means of which the joints are perfectly made. Its fine texture, imperishable nature, and pleasing color have caused it to be much used for building purposes, and ornamentation or trimmings, especially for houses built of brick.

In Ohio and several other Western States are quarries of a sandstone of a drab color, used for the purpose of building. This stone is often brought East, even within the neighborhood of granite itself for the purpose of trimmings or ornamentation, as the color harmonizes well with that of the brick.

Upon the whole, the United States are furnished, at convenient points, with an abundance of building-stone of various grades.

MARBLE.

101. The marble of Vermont is unquestionably the finest in the Union. A remarkable series of detached deposits of this stone, and of various grades of excellence, runs entirely across the State from south to north, the finest portion being in the vicinity of Rutland. The veins or deposits of good marble are nowhere very large. Usually that which is the deepest down in the bed is the purest and of the finest texture. Some of this is very white

and suitable for statuary, but it is not in large masses, nor in continuous veins. A very large amount of the marble used in the Union for furniture and fancy work comes from Vermont.

102. **Liability to Injury.**—Fine marble is very delicate in its texture, and liable to be jarred and cracked and permanently injured by blows of the tools in getting it out of the beds; hence ingenuity has invented diamond-toothed saws, which, driven by machinery, and guided, run horizontally or otherwise, cutting out the marble without injuring it by the concussion—the impure stone or earth having been first removed from the edge of the marble to be cut out. Quarries of black marble are also found in Vermont, and in Pennsylvania, near Williamsport.

GYPSUM, WHETSTONES, KAOLIN, AND GLASS-SAND.

103. Gypsum of a coarse kind is found in great quantities in Michigan, and it is also found in Arkansas, but in the latter State the quality is remarkably fine; it is white as snow, and known as alabaster. In this State, in the vicinity of the famous Hot Springs, is an extensive deposit of the peculiar stone from which hones are made for sharpening razors or tools requiring a very fine edge. This whetstone is fashioned to some extent at the quarry, but the greater part is sent elsewhere, principally to New Albany, Indiana, to be manufactured. The harder varieties of this fine-grained stone are also used extensively by engravers.

Kaolin, for making porcelain, is found in different portions of the Union, especially in Vermont and North Carolina; the latter has also valuable ledges where *mica* is found in large quantities.

Sand for making glass is obtained from deposits in large amounts in many places. On the Youghiogheny River, *forty* miles from Pittsburg, are immense ledges of sandstone; when this is ground, and the pulverized matter washed, the result is a beautiful white sand used for making glass.

SALT.

104. Salt is found more or less in several States of the Union, but in only three or four places in such quantities as to warrant extensive works for its manufacture. In the vicinity of Syracuse, New York, are the most important salt-works in the United States. The water is pumped up from apparently inexhaustible underground lakes of brine, which do not seem to be weakened by the vast amount of water drawn up from year to year. Immense reservoirs—covering more than *fifty* acres—are filled from the wells during the winter, to be in readiness for spring, when the boiling and evaporating begin.

Salt-water is found in Michigan in several places. The most prominent wells are in the Saginaw Basin; they produce an abundance of brine that yields 80 per cent. salt. The water is reached at the depth of 800 feet.

In the northwestern portion of Kansas are native springs of salt-water of excellent quality, and

in great abundance; the brine yields a large percentage of salt.

West Virginia has been famed for extensive salt-wells in the valley of the Great Kanawha. These wells are very rich in quality and in the amount of salt produced; it is here manufactured at a small expense comparatively, owing to the cheapness of coal, which is both abundant and near at hand. Texas has vast deposits of rock-salt, and Arkansas salt-springs.

MARL AND PHOSPHATES.

105. One of our natural resources is in having materials at hand to enrich the soil and prevent its losing the power of producing crops, or becoming exhausted by excessive planting or sowing. The vast abundance of limestone, that seems to exist almost everywhere, and whose elements penetrate the native soil, is likewise extensively used as a fertilizer in the form of lime. Other materials for enriching the soil and producing fine crops have also been found and brought into extensive use, such as marl and phosphates of lime.

106. **Marls and Phosphate-Rock.** — New Jersey has vast deposits of marl along the eastern portion, lying at a short distance from the ocean. This is one of the finest manures in the world, being suitable for almost every crop of the garden or the field, the orchard or the meadow. In some places dredges driven by steam scoop up this marl and drop it into cars at a rapid rate, to be conveyed where needed.

South Carolina has immense beds of marl; they commence only a few feet below the surface, but extend down for hundreds of feet; they are estimated to cover 100 square miles. These beds extend along the coast in what is termed the low country. This marl is of an extraordinary fine quality, 90 per cent. of it being a carbonate of lime; but still more remarkable is the layer of "marl-stone," or "phosphate-rock," which covers this marl. The average of phosphate of lime in this rock is 60 per cent.

In this deposit are imbedded the bones and remains of marine and fresh-water animals, in enormous quantities; these bones appear to be a concentration of the phosphate of lime, which is deemed, when properly prepared, one of the very best fertilizers. This source of wealth has only recently been discovered and brought into use. There are numerous deposits of marl more or less extensive in different portions of the Union, but none so important as these just mentioned.

MINERAL SPRINGS.

107. The United States have quite a number of mineral or medicinal springs; these are found in a number of the States. Of New England perhaps Vermont has the greatest number, though none of them produce large quantities of water; they have a fair reputation because of the remedies they provide for special diseases.

New York State is quite eminent for sulphur springs, as at Richfield, Sharon, Avon, and Clifton,

the latter affording an abundance of water from several springs. Those of Saratoga are the most striking, as they are peculiar in many respects; they being an attraction because of the medicinal virtues of their waters, which of themselves are both palatable and refreshing. The visitors find pleasure in drinking them for their own sake, as they come bubbling up, cool, clear, and sparkling, forced to the surface from unknown depths by the pressure of gas. The waters of one or two of the springs, however, are so unpleasant to the taste, and so medicinal, as to be used only as remedies. There are about *fifteen* springs in Saratoga proper; a mile or two toward the northeast, down the valley, are *ten* more, and at about the same distance toward the southwest are *four* valuable wells, the water obtained by boring one or two hundred feet. The waters of no two of these springs or wells are precisely alike, but all have more or less soda.

108. **Sulphur and Alum Springs.**—Virginia and West Virginia have a large number of springs; in these sulphur predominates as an ingredient; but no two are absolutely alike, either in their properties or in their temperature. In some of these springs alum is the chief ingredient. They are eminently medicinal in their character, and are not attractive for their pleasant taste; but they are said to be unsurpassed in their health-restoring properties in certain diseases.

109. **What is said of the Hot Springs and others.**—The Hot Springs of Arkansas are deemed purely medicinal, and have a great reputation for

their healing properties. They are fifty-seven in number, and afford an abundant supply of water—about 350 gallons a minute—the temperature of which ranges from 95° to 150° Fahr.; this renders them very effective by means of baths in relieving certain ailments, especially those that are rheumatic or scrofulous. The narrow valley into which the springs flow from the side of the mountain is at an elevation of 1,500 feet above the sea.

In many portions of the country are medicinal springs, having a local reputation, more or less, for their healing properties, but each of these, for the most part, furnishes water in comparatively limited quantities.

HEALTH RESORTS.

110. As long as the human system is liable to become weakened by disease, health resorts will be fraught with blessings to large numbers, and in addition an advantage to the whole country. A good effect incidentally derived from them is the occasion they give for more intercourse among the people of different portions of the Union, and uniting them in bonds of acquaintance and friendship; a very important element in a government like ours, spread over such a great extent of territory and with so many diversified interests. This is a resource whose value is not to be estimated in the ordinary way.

Change of air even, in many circumstances, is sometimes essential for the recuperation of exhausted strength, and for recreation, needed be-

cause of hard labor, mental or otherwise. For more serious maladies, in addition to mineral springs, the United States has several recognized health resorts.

111. **Aiken and Florida.**—Upon the Atlantic coast and slope are three noted Health Resorts: a district in Florida, a portion of the uplands in western South Carolina, and in southwestern North Carolina. The center of the second may be said to be at Aiken and vicinity. In this elevated region—about 700 feet above the sea, and very dry and sandy—is a climate mild, healthy, and balmy during the winter. The balsamic odors of the pines are said to impart to the atmosphere a peculiar healing power. This village, in connection with the region round about for many miles, is much visited by invalids from the Northern portion of the country, in order to avoid the harsh winds of their own homes. The number of these visitors during the winter months is about one fifth the whole population of Aiken; and this number is increasing from year to year.

In the valley of the French Broad River, at an elevation of some 2,000 feet above the ocean, stands the pleasant village of Asheville, North Carolina. Lying between the Alleghanies and the Blue Ridge, it is famed for the beauty of the surrounding hills and mountains. The climate of this whole region is mild, dry, and equable, suited for those afflicted with pulmonary complaints. The village itself and the adjacent district are much resorted to during the summer by invalids; in the winter, also, this dry,

cool climate is found to be invigorating to patients suffering under certain forms of lung-disease.

A still greater number of invalids resort to Florida; and several villages and rural places have been made prosperous by this advent of health-seekers, and of others who, though not absolutely invalids, but somewhat enfeebled, have sought a milder climate. Multitudes of the latter, on becoming permanent citizens, have invested capital in ordinary business, or in fruit-growing.

The climate is remarkably equable: owing, as it is thought, to the nearness of the Gulf Stream, it is mild in winter; so, comparatively, is it cool in summer, owing to the influence of a cold in-shore current from the north. The air is deliciously fresh and balmy. This pleasant region, by the power of steam, can be reached within a day or two from the snow and ice and bleak skies of the North. Many thousands of invalids avail themselves of this delightful climate, especially those having pulmonary complaints, and perhaps as many others for relaxation from the cares of business or of mental toil, or for mere pleasure.

112. **A Dry and Cold Climate.**—Some invalids find that, for themselves, this health resort is debilitating, and they seek a climate the very reverse—the higher latitude, the dry and cool atmosphere of Minnesota and the adjacent region. There, apparently in as many cases, the invalid finds relief from the same disease. The dry and still atmosphere in winter, the bright skies, but severe cold, render the climate so exhilarating that it may be

deemed almost a never-failing antidote to pulmonary diseases, especially in the earlier stages of such complaints. The dry and pure cold air induces an unusual appetite for plain, substantial food, which, by its ready assimilation, strengthens the system and thrills it with the spirit of life. This climate, upon the whole, is bracing, never debilitating.

113. **Sunshine, Altitude, and Dry Climate.**—Colorado is recognized as a health resort, especially in the vicinity of Denver, and in some of the mountains distant from seventy to one hundred miles toward the south. The climate is comparatively dry; it is so far from both the oceans, that the clouds are nearly exhausted before they reach this State, except in the winter and spring months. This resort is proverbial for the many days of the year which have cloudless skies and continuous sunshine. The winters are mild; snow falling but lightly, and cold days being but few. Under certain conditions this climate is deemed remarkably genial for invalids; it differs from that of Florida in the effect that the altitude has upon it, though the temperature is not so mild. Consumptives in the earlier stages of the disease are usually much benefited, if not cured.

114. **A Balmy Air near the Ocean.**—Southern California has been described as almost a universal health resort, or sanitarium. Santa Barbara and vicinity are specially named as a desirable land for the invalid. The town stands on a somewhat narrow plain, looking out on the Pacific, while in the background, on the north, are mountains from three to four thousand feet high. These effectually

shut off the cold north and northwest winds, thus protecting that limited region. The temperature is remarkably equable, a feature of the climate desirable for invalids, to whom sudden changes are specially injurious. In the little indentations along the coast and the small valleys extending from the ocean, are found sites for residences, very delightful because of this mild and balmy air.

The northwest winds and fogs, that are so harsh and penetrating farther up the coast, do not prevail here. It is thought this region will become one of the greatest Health Resorts in the Union. Numbers of persons in feeble health, and, with constitutions weakened by disease, go there to remain and enjoy the balminess of the atmosphere; while thousands of those not blessed, naturally, with vigorous constitutions, but with energy of purpose, are going from time to time from the harsher climate of other portions of the Union to become citizens in these different healthful localities.

SOIL AND RAINFALL.

115. Among the valuable resources of a country ought to be included a good climate and a fertile soil: these combined are of vast importance in promoting the health, success, and comfort of the people. This resource can not be reckoned at a mere *money* value, but it is not the less valuable, nor is it less appreciated by the observing political economist.

The United States, lying within the temperate zone, has a diversified surface and a diversified

climate, but, in proportion to the extent of area, no more than other countries.

116. **The Rich Soil; its Available Value.**—The fertility of she soil in the Union, taken as a whole, is remarkably great. With the exception of a few rough mountains, nearly all of which are storehouses of the metals and coal, there is scarcely an acre throughout this wide domain that can not be cultivated in grain or in grasses for cattle or sheep. The other portion of the soil that is underlaid by coal—at least 150,000 square miles—is peculiarly rich, and of itself is a source of wealth much more in the end than the coal beneath it. Everywhere the value of the soil is incalculable, and the people can secure its fertility and productiveness for evermore by their diligence and care.

117. **The Abundance of Rain.**—Next in importance to the fertility of the soil may be deemed the RAINFALL, as the value of the former would be little indeed, if not enhanced by the latter.

We find the rainfall of the United States, upon the whole, abundant and uniform; but over such an extent of territory it would naturally be greater in some sections than in others, and different in different years, though when the entire area of the country is considered both the uniform amount of rain and the degree of temperature are quite striking.

118. **Comparison of the Rainfall on the Atlantic Slope and in the Mississippi Valley.**—Observations taken for a number of years show that in the spring months—when rain is specially needed—at 30° north latitude, the average rainfall is twelve

inches; from 35° to 42°, eleven and ten inches on the Atlantic slope; in the Mississippi Valley, for the like period and same latitude, the average is fifteen, thirteen, and twelve inches. The spring and summer rains have the greatest effect upon vegetation and the products of the soil. In the summer especially, the rainfall in the Great Valley exceeds considerably that on the Atlantic slope in the same latitudes. The line of fifteen inches average rainfall during the summer extends only to the thirty-eighth degree of latitude on the Atlantic slope; yet it reaches to the forty-fourth in the Valley.

The annual average of rainfall in the entire Valley is about forty-four inches, or three feet eight inches (Blodget); on the Atlantic slope the average is not so great, but on the immediate coast it is about the same. This discrimination—so to speak—in favor of the Great Valley is very striking, as it is and must ever be the granary of the nation. Its native fertility—so much enhanced by a copious rainfall—is almost incredible to those who have never seen it, and, in addition, there is scarcely an acre of its area that can not be cultivated. It may be remarked that the annual average rainfall of Europe is only twenty-four inches, as ascertained from the statistics of seventeen cities.

119. **Rain on the Pacific Slope.**—The same abundance of rainfall is on the Pacific coast, especially in Washington Territory and Oregon; in the northern part of the latter the annual average is forty-four inches; at San Francisco it varies from twenty-three to thirty inches, according to some

authorities. The greatest part of the rain in this region is during the spring, thus making the wheat crop grow vigorously; then comes the dry season of summer, which matures the grain in a manner equally remarkable.

120. **The After-Blessings of the Rain.**—The blessings of this heavy rainfall do not end only in making abundant the products of the soil, but the earth also stores the water; and the United States is made a land of pure springs and crystal brooks—far superior in this respect to any other. Nowhere, especially in the Great Valley, can one fail to find clear and sparkling water by sinking a well of sufficient depth. The water falling within the Valley upon a level plain or moderately undulating surface, does not flow off rapidly, but penetrates the earth, and there remains to sustain the grass and grain, and to be found when sought.

121. **The Current and Evaporation.**—We leave to the meteorologist to explain fully nature's process, by which seed-time and harvest is assured to the Great Valley. Yet this much may be said of the advantage it derives from an ocean-current, which, passing from the west coast of Africa, flows across the Atlantic into the Gulf of Mexico, out of which, as the Gulf Stream, it rushes northeastward between Cuba and Florida, bearing with it the warmth that makes the mild climate of western Europe. The special benefit which the Valley receives comes from the immense amount of water which rises in the form of vapor from off this warm ocean-current, heated as it is to about 80° Fahren-

heit, by passing some 3,000 miles under a tropical sun. It is estimated that this vapor carries into the air annually *fifteen* feet of water in the form of vapor, from off a belt of the ocean more than 3,000 miles wide. (Maury, p. 102.) Much of this vapor is carried by the trade-winds toward the west, till they come in contact with the highlands of Mexico; thence, as the theory is, a portion being deflected northward, follows up the valley of the Mississippi and those of its tributaries. Meeting with a cooler atmosphere, these vapors are gradually condensed to clouds, which from time to time pour down their blessings in abundant rains. These are the pledges the Creator has given that the Valley will always be fertile, and seed-time and harvest will never fail.

122. **Buffalo-Grass; the Change of Climate.**—About midway, and west of that point, between the Mississippi and the Rocky Mountains, the prairies, in their original state, are covered with buffalo-grass, which seeds in its root. These roots are not deep in the earth, and when turned over by the plow, they die, decompose, and become a valuable fertilizer of the soil, and give place to cultivated grasses. The roots of the buffalo-grass are so compact and matted that the rain scarcely reaches the ground, but runs off as if from a roof; but, when the soil is plowed and cultivated, the water penetrates the earth, and feeds the crops. At Fort Riley, near the junction of latitude forty and the one hundredth meridian west, the average annual rainfall is twenty-four inches (Guyot). This portion of the prairies, a quarter of a century ago, was

deemed valueless for cultivation; now it has become a great source of wealth, as is evidenced in the abundant crops of wheat and other grains harvested from year to year. In addition, it is found that in this section a change of climate is going on, and the rainfall is gradually increasing, as the lands are brought under cultivation. The earth now retains more moisture, both from the rain and dew, since the water penetrates the soil deeper along the roots of the grass and grain. On the plains in eastern Colorado, the rains mostly come in the spring and early summer; and the amount that annually falls is from twelve to eighteen inches. The buffalo-grass is retreating westward before the farmer at the rate of about five miles a year, on a line running north and south.

123. **Irrigation; Effect on the Alkali of the Soil.**—In the regions nearer and along the east and west slopes of the Rocky Mountains, and on the eastern slope of the Sierra Nevada, the rainfall is comparatively light, and irrigation is much employed in order to produce crops, the water for which is obtained in abundance from those inexhaustible reservoirs—the melting snows in the mountains. The soil of the regions just mentioned is impregnated with alkali to such an extent that it was thought to be an insuperable barrier to their cultivation. Experience, however, has demonstrated that water has a marvelous effect in decomposing the alkali and converting it into a fertilizer.

124. **Advantage derived from Two Oceans.**—The territory of the United States, extending as

it does from the Atlantic to the Pacific, is narrow when compared with the combined width of Asia and Europe. On the parallel of forty degrees the difference is about 5,000 statute miles, and on the parallel of forty-four degrees it is about 4,500. The area of the United States has the advantage derived from the evaporation off both oceans, as they are apart on the thirty-second parallel about 2,640 statute miles; on the fortieth parallel, 2,862 miles; and on the parallel of forty-two, 2,675. The Great Valley, as has been noted, is specially open on the south to the vapors brought by the trade-winds over the Gulf of Mexico, while on its northern border lie the waters of the Great Lakes. In consequence of the proximity of these oceans, the United States have no such dry areas of territory as are found in some portions of the Old World; neither do they have mountains so high as to impede totally the vapors off the ocean from passing over them and descending in rain.

CLIMATE.

125. The climate of the United States has been described as "uniformly variable," and the extremes of heat and cold in certain portions are great, yet the climate is admitted by all to be healthy. The eastern portion is not as mild within the same parallels as the western, for the Atlantic slope, especially in its northern part, is more or less subject to the harsh northeast winds from off the inner cold currents along the coast, while the balmy winds from off the comparatively warm waters of the Pa-

cific have their influence upon the western slope. The mild and even temperature of the Great Valley is quite remarkable. It being open at both ends, north and south, the warm winds from off the Gulf —which seem to follow up the Mississippi and its tributaries—moderate the cold of the northern portion, and in turn the summer heat of the southern part is moderated by cool winds from the north. The equable temperature of the waters of the Great Lakes has also a softening influence upon the climate of the northern portion of the Valley. Thus in the main its climate should not, at any time, be classed as oppressive, as these modifying influences exert their power usually within twenty-four hours.

126. **Influence of the Northwestern Climate.**—More than this, the warm winds that find their way from off the Pacific and through the gaps of the Rocky Mountains, moderate the temperature of all the region of the Northwestern States and Territories. Even on the Saskatchewan, latitude 51° north, in the British Possessions, the average temperature of summer is the same as that of New Haven, Connecticut—ten degrees farther south—and the average temperature of the winter on that river is the same as that at Plattsburg, New York—six degrees fifteen minutes farther south. This fact is cited because the mild climate of that region has a beneficial influence upon the general temperature of the States and Territories directly south of it.

At Fort Benton, in Montana, on the upper Missouri—48° north latitude and 111° west longitude—the average temperature for the season of spring is

the same as at Pittsburg, Pennsylvania—eight degrees farther south—and the middle portion of New Jersey; for the summer, the same as at New York City; for autumn, the same as at Pittsburg, Pennsylvania, and at Providence, Rhode Island; and for winter, the same as at Oswego, New York, and New Haven, Connecticut. The influence of this comparatively mild climate is seen in the large production of the native grasses and wild fruits of all that region.

127. **Comparisons of Temperature on the Pacific Slope, and the Probable Result.**—The mildness of the climate still farther west is much more remarkable, as it is influenced directly by the winds from off the Pacific; in the same manner the climate of western Europe is modified by the winds from off the Atlantic—the one heated by the warm waters of the Kuro Sivo or Japan Current, and the other by the warm waters of the Gulf Stream. At the straits of Fuca, in the northwest of Washington Territory, latitude 48° 30′ north, ice is almost unknown; and flowers, housed in the Middle States during the winter, bloom here in the open air the year through. At Sitka (57° north), in Alaska, the average temperature is very nearly the same as that at Washington, District of Columbia—39° north; and on Puget Sound—48° north—the winters are as mild as they are at Norfolk, Virginia—37° north. The same influence is felt down the coast as far as San Francisco.

These warm winds penetrate the gaps of the Rocky Mountains and influence the climate for hundreds of miles east of them. It may be reason-

ably expected that in time the northwest portion of the United States, including British Columbia, will become as densely populated as the corresponding portions of Europe, since the former is equally blessed with a fertile soil, warm winds, and moisture.

PRODUCTS OF THE SOIL.

128. We have seen the resources of the United States as stored within the earth, and it may be fitting to notice what is derived from its surface—the soil—as a national source of much greater wealth and comfort. The soil of the United States, taken as a whole, is remarkably fertile, and throughout the entire extent of the cultivated portions of the land it is laid under contribution, and its productions are enormous. These annual products far transcend in value the proceeds of all the minerals combined.

129. **Extent of the Wheat Belt.**—The belt of the wheat-producing region stretches from ocean to ocean; not so wide on the Atlantic slope, only running far south on the highlands; it widens in the Great Valley, both toward the south and to the north beyond the Canada line, and west of the lakes beyond the forty-ninth parallel, while on the Pacific it not only runs farther south, but still farther north into British Columbia. More than half the area of the United States is included within this belt; but especially the Great Valley may be considered the granary of the Union. Here can be seen the golden wheat in fields from 10 to 10,000 acres and even more; still larger fields are some-

times seen on the Pacific slope. The climate is so diversified and the area so extensive that, if there should be droughts in some portions of the land, there would still be ample rain and sunshine in others, producing crops sufficient to supply the wants of the people, so that, humanly speaking, there would never occur a famine or great want of the necessaries of life. In some portions of California, nature has furnished such a climate and soil that, by means of irrigation, two crops a year can be raised—wheat or barley—and on the same ground a crop of Indian corn.

130. **The Indian-Corn and Cotton Belt.**—The area of the maize or Indian corn overlaps the wheat belt far above its southern limit, and extends in its greatness to the extreme south, where it grows luxuriantly side by side with sugar-cane and cotton. The latter has an area sufficiently large and a soil sufficiently fertile to supply with this important article of necessity not only the people of the United States, but also Canada and Europe. This crop is more available in commercial exchange than the cereals—wheat and Indian corn—as the latter's value for exportation depends somewhat upon the abundance or failure of the crops of Europe; but cotton in its various grades, from the finest sea-island to the long-staple of the upland, has virtually a monopoly of the world.

131. **Rice, Sugar, and Tobacco.**—On the lowlands along the South Atlantic coast, and on some portions of similar lands on the north shore of the Gulf, rice is cultivated extensively, and pro-

duces a grain of most excellent quality. In Louisiana and Florida, on certain lands, sugar-cane can be grown in abundance. In the latter State the cane grows very luxuriantly, coming to full maturity.

Tobacco is cultivated over a very large extent of country, but in detached districts, and may be noticed as a source of wealth that seems to be increasing. It is both produced and manufactured as an article of merchandise between different sections of the land, and also with foreign countries.

132. **Minor Grains and Vegetables.**—In the northern portion of the United States extends a belt across the continent where the grains, such as oats, buckwheat, barley, and rye, are cultivated to a large extent. The amount of vegetables raised in the Union is enormous; the sweet potato of the South in its varieties is used extensively in the North, while the white or Irish potato of the latter region is there raised more abundantly, is more used, much more productive, and in the main more valuable.

GRASSES.

133. Not the least, by any means, are the resources of the United States arising from the combination of a fertile soil with an ample rainfall and genial climate, in the production of both native and cultivated grasses, in the forms of pasturage and hay. We can scarcely appreciate the value to the nation of the native and nutritious grasses that grow upon the uplands of Texas, and extend north over the plains between the Mississippi and the eastern

foot-hills of the Rocky Mountains, when we learn of the untold multitudes of cattle that feed upon these grasses, and that from this source must ever come nearly all the beef supplies for the eastern and middle portion of the Union. Nor must we neglect to notice the herds which feed upon the fields that once were prairies; nor the cattle upon a thousand hills in the Eastern States that feed upon cultivated grasses. In several States, such as New York and Kentucky, large herds of cattle are raised, and in others where the climate is mild, and but little shelter required.

134. **Cultivated Grasses and Dairy Products.**—Within a large belt extending across the northern portion of the Union the cultivated and native grasses seem to be specially nutritious, and to possess in an unusual degree the elements that insure the best and most abundant proceeds of the dairy. Two products of the dairy in the form of concentrated food—cheese and butter—have increased very much within late years. This increase is likely to continue. The demand for this food is great at home; meanwhile the export to Europe has increased enormously. Statistics show the product of the dairy in the whole country to be valued at about $350,000,000; one third more in value than the cotton crop, and only one fifth less than the corn crop. Great improvements have been introduced in making cheese by means of factories, and also more recently in making butter in similar factories, called creameries. These improvements have produced a much better article at less ex-

pense. This is an application of industry that, from the nature of the case, will continue to increase with the wants of the future. Upon these grasses feed also immense flocks of sheep, supplying both wool and food. That noble animal, the horse, we raise in great numbers, because of our facilities of pasturage, hay, and grain-food to nourish them. The surplus is exported to Europe.

135. **Maize utilized; the Improvement in Stock.** — The maize, that is cultivated in such abundance, enables the country to utilize, to great advantage, the many millions of swine which furnish so large an amount of food for the people and also for export. A marked feature may be noticed in the continuous improvements made in the breeds of domestic animals. It is found that, by proper care, the successive generations of these animals, one after the other, may be improved in various ways by those who rear them. This is specially noticeable in the cattle, in horses, in swine, and in sheep; in the latter, not only in respect to the production of fine wool, but in that of sweet and nutritious mutton. This can continue to be a *resource* increasing in value from age to age.

FRUITS.

136. In connection with the native resources of the country are classed the fruits, so numerous and so useful in adding to the sustenance and the comfort of the people. This includes the fruits of the temperate zone as well as those of the sub-tropical.

Of orchard-fruits the apple is the most abundant

in the United States, as it covers a much greater area and is more cultivated than any other fruit. The apple-producing belt extends across the entire middle and northern portion of the Union, and stretches far south on the plateaus and highlands. This prince of fruits has qualities that render it by far the most valuable of all our orchard productions; though it is so common and so abundant that its peculiarly superior properties are liable to be overlooked when compared with others, less common and shorter-lived. The numerous varieties ripen at different times, some on the tree during the summer and autumn, others only after having been stored away perhaps for months, and, instead of deteriorating, they become more luscious in flavor and taste. This peculiarity of being stored away to ripen enables the merchant, in the mean time, to transport them long distances within our own country, and to export them in immense quantities to foreign lands. Then, again, the value of the apple is greatly increased by the many forms in which it can be prepared for food. Statistics show that the apple crop is valued at more than $50,000,000 a year.

137. **The Peach Belt, the Minor Fruits, and the Vine.**—The peach, though luscious as a fruit, can be preserved only for a short time in its native state; its flowers are very tender, and liable to be blasted by the frost or sudden change of temperature, frequently causing the failure of the crop. One trait renders the peach very valuable—its capability of being canned and preserved, but a little at

the expense of its delicious flavor. This defect is almost entirely obviated by an ingenious process of recent introduction, in which only the water of the *ripe* peach is evaporated. When this evaporated fruit is prepared for use, the flavor of the original peach is scarcely impaired. The peach-producing area, compared with that of the apple, is quite small, including only a limited portion of the Atlantic slope, principally in the States of New Jersey, Delaware, and Maryland, and farther south, a strip along the eastern foot-hills of the Alleghanies, and to some extent in Florida. In the Great Valley the peach flourishes in the north middle portion, and west of the Mississippi in the new States and Territories, and in California, but to a limited extent. Some years the peach crop amounts in value to $46,000,000. Side by side with the apple and the peach flourishes the pear, and the minor orchard-fruits — plums, apricots, and cherries. The pear crop is valued at about $14,000,000, and the grapes at about $2,000,000. The total value of the fruit crop is $138,000,000. Recent improvements in canning all these have enabled the people to have fruits in that form the year through. Within the region producing the apple and the peach we find the vine growing and bearing fine grapes for table use, and in some instances for making wine—preëminently in California. In portions of the Great Valley the vine is very productive, and furnishes wine of fine flavor.

138. **Florida; its Oranges and Small Fruits.** —In the extreme southern portion of the Union grow tropical and sub-tropical fruits. The gardens

of Florida are wonderful in the amount of their productions of small fruits and vegetables, which begin to ripen in April, such as peas, strawberries, blackberries, and also sweet potatoes and tomatoes; but the most important fruit of this State is the orange, deemed for its sweetness and flavor the best in the world. The groves of orange-trees are beautiful beyond compare; the golden fruit appearing amid the green foliage and white blossoms, while the fragrance penetrates the whole atmosphere.

Here grow also in abundance peaches, quinces, and pears, cherries and plums, and luscious grapes, side by side with the lemon and the lime, bananas, and other tropical fruits. These are transported in large quantities to the cities on the Atlantic slope; while in the Valley they are supplied from Louisiana, which also grows oranges and other tropical fruits.

139. **Small Fruits of Virginia and Delaware; the Trade of Norfolk.**—In connection with this may be mentioned the same early small fruits produced farther north, such as the strawberries and other berries, which are grown in immense quantities in Delaware, and Virginia in its eastern portion. Norfolk is the main depot for the early vegetables, which are cultivated in great quantities in that mild climate and fertile soil, and furnished to the Northern markets. Owing to the facilities of rapid transportation, both by railway and steamship, the benefits derived from the rich and cultivated gardens of Florida and Virginia extend over a large region of country, and are enjoyed

by millions of people, though distant hundreds of miles. The value of this resource is not to be reckoned entirely as a mere pecuniary consideration, because it comes in the form of an enjoyment and a producer of health.

140. **The Numerous Fruits; their Excellence.**—Then comes California, with its fruits of marvelous size, but not so well flavored as those that are smaller. The southern portion especially is abundant in its production of oranges, lemons, citrons, olives, hard and soft shell almonds, bananas, and other fruits of a warm region. The orange-groves bear finely, but require irrigation to produce the fruit in perfection; the trees are as fruitful as those of Florida. The olive-orchards are large and bear fruit of fine quality, equal to that of France or Spain, "plump, juicy, and of full flavor"; the oil produced is equally excellent.

141. **The Walnut, the Vine, and the Sugar-Beet.**—The English walnut, though of comparatively recent introduction, flourishes finely and bears well, the climate being adapted to make the fruit perfect both in size and flavor. The climate and soil of California combine in some districts to make the vine grow luxuriantly, and bear grapes of extraordinarily fine flavor; the amount produced is simply enormous—a large percentage of which is used in making wine. We find both California and Florida fruits side by side in the markets of the Atlantic cities—while the apple of the North interchanges with the orange of the South. In California the climate and soil seem to be also admirably

adapted to produce a sugar-beet of excellent quality; the beets raised have an unusual amount of saccharine matter. The industry of making sugar from these beets has been thus far very successful.

142. **The Great Improvement; the Value of the Fruit Crop.**—An important and very interesting feature of this culture is that, by judicious management, a continuous improvement in the quality of these various fruits can be produced. By means of this susceptibility of nature, the value of each kind of fruit is increasing from year to year. As different varieties can be obtained by careful cultivation, and a selection made of the best to plant or graft, the result will be an excellence of fruit hitherto unknown. This improvement is carried out with equal success in respect to the small garden fruits. At this rate of improvement we may imagine the excellence of the fruits of the future. The total value of the fruit crop of the United States is found by statistics to equal that of *one half* the value of the average wheat crop of the entire country.

FORESTS.

143. The timber-lands of the United States are no small source of utility and of wealth. The State of Maine has extensive forests, from which has been taken an immense amount of timber for ship-building, domestic use, and for export. Though this drain has been going on for more than half a century, yet these woods are by no means exhausted. There are extensive and valuable forests on the sides and the foot-hills of the White Mountains, and

in the valleys around them. There is also an abundance of timber in the Adirondacks and the Catskills, while the Alleghany Range is rich in its forests on both sides, east and west; on the east side extending toward the Atlantic coast for more than one hundred miles, and on the west to the edge of the prairies and to the Mississippi. The pine-forests of the Carolinas and Georgia are valuable in many respects, as they furnish most of the turpentine of the world, besides a large amount of lumber. The forests along the north shore of the Gulf are rich in timber, while the fine-grained cedars of Florida have a peculiar value for the making of lead-pencils. Certain portions of Texas and Arkansas, especially the lowlands, are covered with a dense growth of valuable trees.

144. **The Isolated Woods; Forests of Sierra Nevada and Cascades.**—In Michigan and other Northwestern States are very extensive isolated woods that will afford a vast amount of timber in the future. In the Rocky Mountains, in certain portions, are also forests, while along the Sierra Nevada and Cascades exist timber of gigantic growth—pines, firs, and cedars—not to mention the groves of the "Big Trees." Along the Coast Range also are extensive districts thickly set with large trees.

145. **The Forests of Oregon, Washington Territory, and Alaska.**—But all these are insignificant when compared with the immense forests of Oregon and Washington Territory. These partake of the same general character. Trees of im-

mense size loom up from 100 to 250 feet in height, and of proportionate diameter, and stand remarkably thick upon the ground—a storehouse to supply more especially the Pacific States and South America, Japan, and China. To the two latter countries this lumber has already found its way, and also around Cape Horn to Rio Janeiro.

The extended shore of Alaska, on the south and southeast, is covered with dense forests of fine timber, especially the strip of territory that lies for 400 miles along the ocean, and extends back on an average of about 140 miles to the crest of the mountains, the line dividing British Columbia from Alaska. The trees consist of the pine, cedar, spruce, hemlock, and many other kinds.

In addition to the extensive forests just mentioned, there are remnants of the primitive woods scattered all over the country; these, for the most part, are sufficient to supply local wants. It is proper to mention the efforts made by the National Government and some of the States to save the forests from wanton destruction, and the encouragement they give the people to plant trees, as on the prairies, in order to furnish timber for the future.

RESOURCES OF FRESH WATERS AND OF THE SEA.

146. In enumerating the resources of the Union, those of the fresh waters should not be overlooked, since numerous rivers afford facilities for the transportation of merchandise and for travel, and the fisheries of the Great Lakes furnish large quantities

of food to the inhabitants of the cities near their shores, and also to the people in the interior of that section of the country. The fish obtained also from rivers in different portions of the land at certain seasons is no small item of value.

We would appreciate more fully the benefits we derive from our fresh waters in the form of ice, if, after testing its usefulness, we were deprived of it. Less than half a century ago, ice, from its scarcity, was deemed a luxury; now it has become a necessity, and its application to domestic and useful purposes has increased enormously. It confers untold blessings of health and comfort upon the inhabitants of the cities and large towns, by making the waters with which they are supplied cool, wholesome, and palatable.

147. **Utility of Ice.**—The value of the varied supplies of food derived from the sea and from the lakes has been greatly enhanced within the last half century by the use of ice. This can be said, especially, in respect to fish that are taken to supply the daily markets of the cities along the shores and coasts, and of others farther inland. These are packed in ice and kept fresh while being transported in steamships along the coast, or on railways for long distances into the country. The Eastern cities can now receive meat fresh from the herds of cattle or flocks of sheep in the Great Valley or the Southwest by means of refrigerating cars. This mode of supplying food is only in its infancy, but it is an earnest of national benefits to be increased indefinitely in the future.

148. **The Storehouse of Food.**—The food supplies obtained from the ocean are very great. The waters thus laid under contribution extend from Eastport, Maine, to the mouth of the Rio Grande, and from San Diego Bay to the straits of Fuca. The waters along the Atlantic coast, and in the bays and sounds connected with it, swarm at all times with fish, while at certain seasons come other fish in immense numbers from the depths of the ocean to feed on the banks or shallows off the coast. Some of these feeding-grounds are so near the shore that they may be deemed neighboring: such as St. George's Shoals, second in importance only to the Banks of Newfoundland, in the multitudes of codfish found there feeding on the seaweed or grass. These shoals are visited almost alone by New England fishermen.

The United States have also an interest in the fisheries off Nova Scotia, on the Banks, and around Prince Edward Island. Off these shores American fishermen capture immense quantities of the food-fishes: such as herring, mackerel, and cod. They have taken in a single year 350,000 barrels of mackerel, and a much greater quantity of cod. In this business there are employed sometimes 10,000 men.

149. **The Fishing Industry.**—In New England many inland towns and cities derive large supplies of food from the fisheries along the coast, while others on the shore engage extensively in the business of fishing as a means of livelihood. Gloucester, Massachusetts, is the most prominent in this branch of industry. That city sends out annually

more than 500 vessels along the coast or to St. George's Shoals. At one season they fish for cod, at another for halibut, and at still another for mackerel. These "catches" in turn are prepared for market, both domestic and foreign. The product of the New England fisheries amounts in value to several million dollars a year, one half of which belongs to Boston.

Other fisheries are nearer at hand, such as for bluefish, tautog, and other kinds, that are drawn upon to furnish daily supplies to the cities near the coast, and to others farther inland; to the latter the fish are sent packed in ice.

150. **The Menhaden and Shad.**—In Long Island Sound and along the Jersey shores are found nearly all these classes of fish, and, in addition, the menhaden or whitefish, in such multitudes that they are used extensively for manuring the land, and for obtaining oil by pressure. The flesh of this fish is sweet and nutritious, but almost useless on account of its being so very bony. Recently ingenuity has invented a machine that takes out the bones; then the fish are prepared and put up after the manner of French and Italian sardines, which they are said to rival in sweetness and flavor. (Simmonds, p. 82.)

In the spring months the lower portions of the rivers flowing into the Atlantic swarm with shad, while within the sounds and small bays they are equally plenty. The shad are furnished in vast quantities to the inhabitants of the cities near these waters, and also to the towns farther inland, by being packed in ice and sent by railway. The coast

of North Carolina, at this season, is specially prolific in both herrings and shad. At the mouth of the Chowan, in Albemarle Sound, 300,000 herrings have been caught by means of seines in a single day; and shad from 1,000 to 2,000 at a catch. "Steamers are at the wharves constantly loading with these fine fish, packed in ice, for New York and other Northern markets." (Simmonds, p. 60.) In addition, immense numbers are cured by salt and put up in appropriate vessels to supply the people during the year. Fish in great abundance and varieties abound in the northern waters of the Gulf of Mexico, and in the Mississippi, especially in its lower portion.

151. **Fish-Culture.**—It is proper to note the remarkable success of fish-culture as directed by the National Government and private associations. This effort to develop the resources of nature is only in its infancy; but the indications are that it will result in incalculable advantage to the country in affording valuable supplies of food.

OYSTERS.

152. In many of the inlets and sounds along the Atlantic coast are more or less of native oysters, but none of these beds compare in value with the treasures of that shell-fish found in Chesapeake Bay. In addition to the millions of excellent fish that swim in the waters of the bay, a great portion of the bottom is literally covered with oysters spontaneously produced, and the finest in the world. From the bay vast numbers are carried in sloops

and planted, as the term is, in waters farther north. After finding a suitable place in some bay or inlet, they are thrown overboard; the oyster left to its own resources easily obtains food, and in due time grows large and fat, and becomes ready for market.

In the small bays and inlets around New York City, especially in Long Island Sound, and along

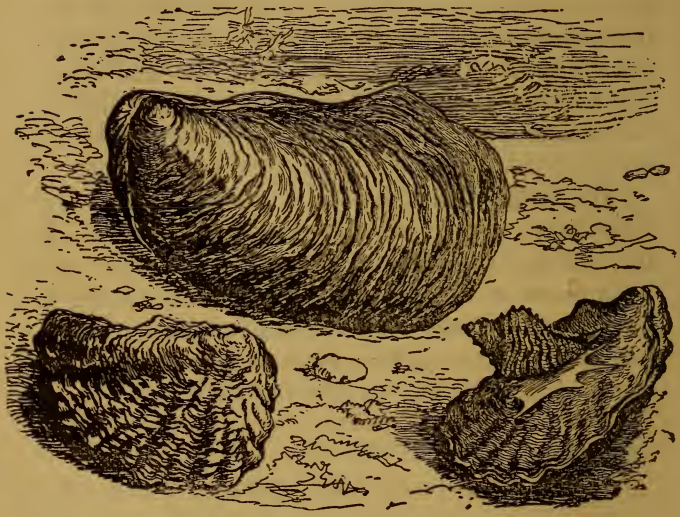

FIG. 11.—Oysters.

the Jersey shore, are oyster-beds thus planted in great numbers. The importance of this source of food and wealth may be inferred from the estimated value of the trade in oysters carried on in the Metropolis—it amounts annually to many millions of dollars. There are about 150 sailing vessels,

manned by at least 700 seamen, engaged in this business around New York alone.

153. **Canned or Pickled Oysters.**—The business of pickling oysters is carried on extensively at certain places on Long Island Sound. Fair Haven, one of these, is the largest oyster-mart in New England. About 4,000,000 bushels are brought yearly to this place from the Chesapeake and the neighboring waters. A portion are planted and the remainder canned, and, when thus prepared, are sent to markets all over the country and abroad.

Norfolk, Virginia, has an extensive trade in oysters, while that of Baltimore is greater than the wheat trade of Maryland. The latter city ships "raw oysters to South America, California, and Australia, and besides to all parts of Europe; and the demand will steadily increase as they become better known, from the fact that Chesapeake oysters, like canvas-back ducks, owe their superior flavor to the food obtained on their feeding-grounds." (Simmonds, p. 144.) In Baltimore are also very large establishments engaged in canning or pickling oysters for consumption in our own country and for foreign markets. In this industry are employed thousands of men during the winter months; the same men during the summer and autumn are engaged in canning fruits and vegetables, which are obtained from the gardens in the region around the city.

154. **Clams and Lobsters.**—The soft clam, next to the oyster, is deemed the most valuable bivalve on the Atlantic coast. Clam-beds are found

along the New England shores in sheltered places; in the mouths of rivers, and in inlets, especially in Long Island Sound. These shell-fish are easily obtained from their beds at low tide; they, at all seasons, furnish a large amount of food to certain classes. The round clams are found in great abundance along the coast from Cape Cod almost to Florida. This shell-fish is very valuable to the fishermen, in furnishing them bait for cod, as that fish seems to have a strong partiality for the flesh of the clam.

Lobsters are found in large quantities along the New England coast; they are valuable for food, but more as a luxury than for common use. Great and increasing numbers are canned and shipped, especially to England, or sent to the cities in the interior of our own country. The drawback to this trade is the fact that the lobsters are rapidly diminishing under this increasing demand, and fears are entertained that ere long the supply will be exhausted. "A few years ago it was not uncommon to catch lobsters weighing from ten to twenty pounds; now the average is from *three* to *six* pounds." It is hoped that effective measures will be taken to remedy this evil.

155. **The Fisheries in Puget Sound and off the Straits of Fuca.**—We now come to the resources of the sea as found in the Northwest. Puget Sound—"the Mediterranean of the North Pacific"—is fully stocked with a great variety of the finest fish—cod, salmon, herring, halibut, and other kinds; oysters and clams are also found in great abundance.

Oysters are here transplanted, as is the custom in Eastern waters, and they also in due time become large and fit for use.

Just off the mouth of the straits of Fuca—twenty-five miles distant—is a bank or shallow in the ocean, a great feeding-place for halibut. They come here in great numbers, are of very large size, and of fine quality. The smoothness of the water aids much in making this fishery valuable, as the halibut are easily taken.

The waters around the entire southern coast of Alaska afford very fine fisheries. The cod and the halibut are of extraordinary size—the latter weighing from 100 to 300 pounds—and herrings in immense numbers. These fisheries will assuredly become a great source of benefit to the United States when properly utilized. Their products have already found their way to Japan and China.

SALMON.

156. The Columbia and its main branch, the Shoshonee, and other tributaries, rise amid the mountains, and are fed by streams made cold by melting snows; in consequence their waters, during all seasons, are remarkable for their icy coldness and clearness: this quality that prince of fishes—the salmon—found out long ago. These fish come in untold multitudes from their home in the Pacific, and from April to August run up the Columbia and its tributaries.

157. **The Process of Canning; the Demand.**—At Astoria, and in the vicinity, are large estab-

lishments for canning and salting down the salmon. These fish do not take bait at this season, and are caught in gill-nets, but only at night, the water being so clear they can see the nets during the day, and, either by swimming above or under them, avoid the danger. Only the largest are thus caught, as the meshes of the nets are unusually large—about eight inches square. The fish range in size from fifteen to seventy-five pounds.

After a series of handlings they are cleansed and prepared for canning or salting. The process practiced here is said to be the only one known by which the flavor of the salmon can be well preserved. Every can is thoroughly tested, and no imperfect one permitted to leave these establishments. The fish is cooked by a peculiar process in the cans, which are then hermetically sealed; they are sent to the home market and all over the world, Old England taking much the larger share. From 7,000 to 10,000 tons of salmon have thus been canned in a single year, and nearly as many tons either salted and put in barrels, and sent to the Atlantic markets, or used in the vicinity.

Notwithstanding the vast amount sent upon the market, the demand is far beyond the supply, and the anticipated product of these fisheries is contracted for before the season commences. Still more marvelous is the assertion of the fishermen, that the number of the salmon entering the Columbia does not seem to diminish from year to year. The value of the salmon here canned is estimated at an annual average of $3,000,000.

158. **Salmon of the Yukon.**—Immense numbers of salmon during the season also run up the Yukon River in Alaska, but the season is much shorter than on the Columbia, and thus far this fishery has not been utilized.

FUR-BEARING SEALS.

159. On the Prybiloff Islands, in Behring's Straits, once a year, congregate fur-bearing seals in vast numbers. These furnish the fur skins from

FIG. 12.—Fur-bearing Seal of Alaska.

which, after many dyeings and dressings, and finishing, is produced the material for that beautiful article of dress—the sealskin cloak worn by ladies. These seals are found scarcely anywhere else, but here they come in sufficient numbers to supply the markets of the world. The United States Government permits only a certain number to be taken, and is very strict in enforcing the laws for protecting the seals from wanton destruction. The number now permitted to be captured is 125,000 a year; from these the Government derives a revenue, more than sufficient to protect them from avaricious and reckless white hunters and the Indians, who were fast destroying the whole race of this valuable seal. Under this judicious management the number of seals is now on the increase.

WILD GAME.

160. One of the resources of the Chesapeake—second only to the oysters in value—is the immense numbers of wild fowl and game that frequent its shores and shoals. This offering of nature to furnish food to man is really a valuable acquisition—it once saved the colony of Virginia from starvation.

These birds consist of wild geese, and many varieties of ducks—the canvas-back the most prominent in value. They are attracted by the abundance of food they find on the great flats along the shores and inlets of the bay. The canvas-back acquires its peculiarly fine and delicate flavor by feeding on a species of wild celery which grows in

the shallows, eight or ten feet deep. These and the other birds are shot and captured in great numbers to supply the markets of the cities within reach. The other bays and inlets farther south, such as Pamlico and Albemarle Sounds, have also, during the same season, a very large amount of wild fowl, which are likewise captured and sent to market.

This large trade has its principal depot at Norfolk, Virginia, from which during the latter part of autumn and winter rapid steamers carry the game daily to market, or to points from which it can be conveyed by railway. This trade is increasing from year to year, as the facilities for rapid transportation are improved.

161. **Their Migrations; the Return with their Young.**—In early spring these birds begin to leave their winter feeding-grounds in the Chesapeake and the other bays and inlets for their breeding-places, to return in the autumn, with apparently undiminished numbers; and thus they have done for ages, we know not how long. They make their way directly toward the northwest, stopping to rest awhile among the lakes of Minnesota and the neighboring States; then they pass on till they reach the Yukon River in Alaska. For hundreds of miles along the banks of that river they build their nests amid the sedges, and hatch their young, living meanwhile upon the wild berries of different kinds that grow in that region in the utmost profusion; upon these they become exceedingly fat. In the autumn, when the young are large enough

to fly, they set out, never making a mistake, but with unerring instinct bringing with them their young to their winter feeding-grounds; meanwhile again stopping on the way to rest at their old haunts amid the lakes of the Northwest.

HOMESTEAD LAW—TIMBER ACT.

162. It is thought proper to add to the "Resources of the United States" a sketch of the Homestead Law and of the Timber-culture Act, in order that those desiring to make their homes upon the public lands may ascertain the process by which they can acquire such homes, and secure for themselves a portion of these lands—*one of the important resources of the Union.*

163. **The Homestead Law** went into effect on January 1, 1863. By its provisions any actual settler, "twenty-one years of age," male or female, the head of a family, "on payment of *ten dollars*, he or she shall thereupon be permitted to enter the quantity of land specified"—160 acres. Also, persons of foreign birth enjoy the same privilege, "provided the immigrant be a citizen of the United States, or has declared his intention to become such." The law also says: "This homestead shall not in any event become liable to the satisfaction of any debt or debts contracted prior to the issuing of the patent therefor." To prevent fraud the settler must be an occupant; that is, live upon the farm he or she has entered, and cultivate it for a

term of five years. On evidence of this compliance with the law, the Government gives him or her a *title in fee* for the 160 acres he or she has entered. In case of the death of the settler before the expiration of the five years, the land is secured by the same law to his or her heirs.

164. **The Timber Act.**—Homesteads may also be obtained by means of the *Timber-culture Act.* The prairies are frequently scarce of timber, and this law is designed to produce forests that may become beneficial to the adjacent region. By this enactment, any person having the same qualifications required of those that enter homesteads, who will "plant, protect, and keep in a healthy, growing condition for *eight years*, *ten* acres of timber on any quarter-section of any of the public lands of the United States, shall be entitled to a patent for the whole of such quarter-section"—160 acres. In the same proportion of planting timber a smaller quantity of land can be secured; that is, the settler can secure 80 acres by planting *five* acres, and so on by planting in timber one sixteenth of the tract occupied. Neither can this homestead "become liable to the satisfaction of any debt or debts contracted prior to the issuing of the final certificate therefor." Residence upon a timber-claim is not required. The homesteads entered under either of these laws are *free from taxation* till the issuance of the last patent or title in fee. The lands within the railway grants can be taken up under both laws, but those under the homestead give the settler 80 acres instead of 160 *outside* the

grant. *The Preëmption Law* secures to the settler upon United States' land the right to purchase in preference to others when the land is sold.

165. **The Results.**—From the annual reports of the Interior Department we find that under these beneficent laws there have been entered in nineteen years—the much greater portion under the homestead bill—about 74,000,000 acres, making 115,625 square miles. This area about equals that of the States of New England and New York combined, as in the surveying for homesteads the surface of lakes and areas of shore-lines on the ocean, which run three miles out, are not included. This area is greater than that of England, Scotland, and Wales together with Ireland combined, if we deduct the water-surface in and around these countries.

The Secretary of the Interior, when comparing the homesteads given outside with those within the railway grants, states their average size to be 120 acres. This would give 616,666 households, which, on an average of *five* persons to each, aggregates 3,083,330 — about three-fifths the present population of the State of New York. The annual average number of households thus established has been for these nineteen years about 31,403. In this calculation is not enumerated the lands sold by the railways, which amount is said to be nearly as large. The combination of the two systems speedily forms settlements sufficiently populated to sustain churches and schools, so dear to the American people.

166. **Railway Grants.**—The National Govern-

ment often gives portions of the public lands to aid in building railways; these make the lands to be occupied more accessible. These grants are varied in extent; when the road passes through public lands within State limits, the grant extends *ten* miles on each side of it; but when through territories, the grant extends *twenty* miles. This is surveyed, as all the public lands are, and divided into acres, 640 of which make one square mile. This is termed a section, but the largest amount given to a settler is one quarter-section, or 160 acres. Another division made is the township or town, which consists of 36 sections or square miles, the *first* and *thirty-sixth* sections of which township are reserved for the school fund of the future State. Then the road receives alternate sections—the odd numbers —and the Government retains the even numbers, and so on. The lands *within* the railway grants belonging to the United States are held at two and a half dollars an acre, just twice the price paid *outside* the grant, so that in theory the National Government loses nothing by conferring these railway grants; but it does confer blessings upon the multitudes who settle upon these lands in furnishing them homes and in bringing them into connection with the older sections of the country and their markets.

167. **The Main Roads.**—The intention was to extend three railways across the plains and mountains from the Mississippi River to the Pacific. Through the middle portion of this territory, one —the Union Pacific—is finished from Omaha to San Francisco. Through the middle of the section

north of the latter road is the Northern Pacific, extending from Duluth, on the southwest part of Lake Superior, also recently finished to Puget Sound; and in the South the Southern Pacific, from Memphis and other points, is completed to San Francisco. Three belts of settlements by these means are extending across the continent. The general Government, in addition to the grants of land to these three great railways, has often given lands on the same conditions to shorter roads within the new States wherein are large areas of the public lands. Cross-roads uniting these settlements will be built in time by the people themselves, as necessity requires.

168. **Homes by Purchase.**—Great numbers, having the means, prefer to own homes nearer these roads than to settle on free homesteads at a distance from them. These purchase farms either from the Government or from the railway companies. The latter find it for their interest to sell at reasonable rates, and, to induce settlers, give a long time for payments.

169. **Character of the Population.**—The people who find homes upon these lands have the elements in themselves to make in the future an industrious and moral population. They had the intelligence to see the means of bettering their condition, and the energy to make the effort. They left the social advantages of the older States, as well as their crowded farms and cities, and pushed out boldly into the wilderness of woods and prairie to find homes for themselves and families, hoping

in due time to have church and civilizing privileges, and, when they need them, schools for their children, the funds for which are secured by the sale of the lands reserved for that purpose.

170. **The Welcome.**—The generous Government and the people themselves welcome the intelligent and moral, the industrious and temperate immigrant from foreign countries to share with them this bounty of the public lands. All that is required of the foreigner is that he should be either already a citizen or have declared his intention to become one, before he can enter his 160 acres and occupy it with his family.

171. **The Good Intent.**—The Homestead Law is preëminently the poor man's friend—an instance of the beneficence of a Government known only by its blessings. By this law the public lands are kept from speculators, and preserved in moderately sized farms for the settler and his children, and thus prevented from being converted into vast landed estates.

172. **Caution** should be exercised by the settlers—both American and foreign—to seek homes on the public lands that lie in or near the latitude that may have a climate similar in its character to the one to which they have been accustomed.

QUESTIONS.

DESCRIPTION.

Sections 1, 2.

1. WHAT is said of the shape of North America?
2. Describe the view from a point over the Isthmus of Darien.
3. Mention the ranges of mountains, and the regions between them.
4. What is said of the portion occupied by the United States?

COAST-LINE, p. 2.

Sections 3—6.

1. Name the estimated coast-line of North America, and that of Europe.
2. How does the surface-area of Europe compare with its coast-line?
3. Name what is properly the coast-line of the United States.
4. How does this surface-area and coast-line compare with that of Europe?
5. Enumerate the advantages of an extended coast-line or navigable rivers.
6. Name the effects of this in ancient and in modern times.

COAL, p 4.

Sections 7, 8.

1. State the importance of coal.
2. Explain how coal has been produced.
3. Compare the growth of vegetation in the "Carboniferous age" with that of to-day.
4. Name the proportion of peat to form a seam of coal, and the estimated time.
5. What is said of the pressure? Give Professor Dana's views.
6. How was the anthracite coal produced? What is said of heat?

Sections 9—12.

1. Explain how the remains of plants found in coal can be compared with those of the present time.
2. What remains are found in the "impervious clay"?
3. Explain the effect of water and the climate.
4. What are peat-bogs?

5. Why are there no vegetable remains in anthracite coal?
6. What was the original character of the entire coal-field?
7. Describe the structure and properties of cannel-coal.
8. Explain why the great coal-field was originally level.
9. Why was a portion upheaved?
10. State how the continuity of the seam has been broken.
11. What does the resemblance of the various coal-seams prove?

THE EXTENT OF COAL, p. 9.

Sections 13—17.

1. Name the number of square miles of coal in the various countries of Europe. How do they compare with their surface-area?
2. What amount of workable coal has France, Belgium, and England?
3. What is the ratio of the coal-area to the surface-area of Europe?
4. How does this compare with that of the United States?
5. What the probable area of coal yet to be discovered?
6. Describe the coal-measures by Fig. 4.
7. Mention the comparative thickness of the coal-seams of England and those of the United States.
8. What is said of the dip of the seams in England?
9. What is said in this respect of the anthracite of Pennsylvania?
10. Give the estimated average thickness of the aggregate seams in the entire coal-field of the Union.
11. Explain why coal is so easily mined in the United States.

CLASSIFICATION OF COAL, p. 12.

Sections 18—23.

1. Name the four classes of coal, and where located.
2. Give the characteristics of anthracite; its common names, and why.
3. What the area and aggregate thickness of seams?
4. State the estimated population dependent on anthracite for heat.
5. Why are there vacant spaces in the anthracite field? (See Fig. 5.)
6. Give the locations of the coal-basins, and their business centers.
7. What the average thickness of the "Mammoth" seam?
8. Where is anthracite found outside Pennsylvania?

SEMI-BITUMINOUS COAL, p. 15.

Section 24.

1. Explain the transition space.
2. Name the basins of this coal and their area.
3. To what class belongs the Cumberland field?

4. Name the aggregate area of the basins.
5. What has been the effect of anthracite on industry?

BITUMINOUS COAL-FIELDS, p. 16.

Sections 25—27.

1. Name the several isolated coal-fields east of the Alleghanies.
2. Describe the Richmond field. What is said of natural coke?
3. What is said of the coal-field of North Carolina?
4. What the location of coal, iron-ore, and limestone, at Johnstown, Pennsylvania?
5. Name a valuable trait of the Alleghany coal.

Sections 28—32.

1. Give the boundaries and area of the Alleghany bituminous coal-field.
2. Describe the water-shed of this great field.
3. Name the rivers, and describe their course to the Ohio.
4. Explain wherein they have aided man in the formation of valleys.
5. Give the name and describe the main seam of this field.
6. Mention its area and thickness at different points.
7. What the rich quality of this coal and its characteristics?
8. Describe the hills along the Monongahela in respect to their coal.
9. Why is it so easily mined? Quote Sir Charles Lyell.

Sections 33—37.

1. Name the peculiarities of the coal at Connellsville. Its use.
2. Describe New River. Name the varieties of coal in West Virginia.
3. What is said of the kinds of coal along Coal River?
4. The vein of asphaltum—how large?
5. What are the varieties of coal mined in Ohio? Their properties?
6. What is said of the coal-field of eastern Kentucky?
7. The coal-field of East Tennessee—how situated?
8. Describe the separate coal-fields of Alabama.
9. For what is Red Mountain remarkable?

CENTRAL COAL-FIELD, p. 24.

Sections 38—42.

1. Name the three States in which this field lies.
2. Give the extent of coal in each.
3. How is this coal reached in the prairie States?
4. Mention the properties of the block-coal of Indiana as to shape, and quality, and use.
5. Give an account of the furnaces at Brazil, Indiana. Whence do they obtain iron-ore?

6. What the number of seams of coal in this field? Where else is block-coal found?
7. How does the coal of the central field compare with that of the Alleghany?
8. Describe the coal-area of western Kentucky.

Sections 43—48.

1. Give an account of the coal-fields of Iowa and Missouri.
2. Mention the characteristics of the singular deposits of coal in the latter State.
3. Name the varieties of coal and their properties.
4. Describe the coal found in Michigan. For what is it remarkable?
5. What is said of the coal of Nebraska?
6. What is the coal-area of Kansas, and what its position?
7. What stone is found within these coal-measures?
8. Give an account of the transition?
9. Describe the coal-field of Arkansas.
10. What is said of the coal found in Texas?

Sections 49—52.

1. Give a summary of the extent of the lignite-coal field.
2. Describe the composition of this class of coal.
3. What is said of the fossils found in it?
4. Give an account of the beds of this coal. What its heating qualities?
5. For what distance found along the Pacific Railway?
6. Describe the mine at Cheyenne.
7. What the estimated area of this coal-field?

COAL ON THE PACIFIC SLOPE, p. 81.

Sections 53—59.

1. To what class of coal does it belong? Its characteristics?
2. Describe the mines at Mount Diablo.
3. Name the properties of the coal of southern Oregon.
4. Give a description and name the coal-fields of Washington Territory.
5. Describe the Bellingham mines. What is the flora like?
6. What the opinions of geologists in respect to the coal of this region?
7. The coal found in Alaska partakes of what properties?
8. What area of coal is available in Nova Scotia?
9. Is it easily mined? What impairs its value?
10. Where is coal found in British Columbia? What its nature?
11. Describe the lignite fields in northwestern Ontario.

IRON-ORES, p. 84.

Sections 60—67.

1. Why is iron so important a mineral?
2. How extensive do these ores exist?

3. Describe the many ways in which they are mined.
4. Name the connections in which they are found.
5. What is said of New England ores, and of the quality of the iron they produce?
6. The ores found in the Adirondacks—how smelted?
7. Describe the deposit of ore found at Stirling Mountain.
8. What is said of the iron-ores of New Jersey?
9. What of that region in respect to its mineral wealth?
10. Describe the preëminence of Pennsylvania in mineral stores.
11. How is this wealth distributed?
12. Give a description of a singular deposit.
13. Give an account of the ore deposits on both sides of this mountain-range.
14. What are their accompaniments?
15. Name the valleys and their extent.

Sections 68—74.

1. Describe the ore deposits of Virginia. Give the names of the ores.
2. Give an account of the belt of iron-ores across the State; the "James River."
3. What the qualities of these ores?
4. What is said of the ore-fields of North Carolina?
5. Describe the ore-field at the southern end of the Alleghanies.
6. What is said of Red Mountain and its surroundings of coal and limestone?
7. Name the detached deposits of iron-ore.
8. Compare the Alleghanies with other mountains in respect to their mineral wealth.
9. How does iron compare with gold and silver in its intrinsic value?
10. Explain the effect of the use of iron upon industry.
11. What change is taking place in respect to iron and steel?
12. Give the names of the iron mountains, and the characteristics of their veins of iron-ore.
13. Give an account of the iron-ores found around Lake Superior.
14. To what places are they taken to be smelted?
15. What has science shown in respect to mixing ores in the furnace?
16. Where else are found masses of iron-ore?
17. How does the United States compare with the world in respect to its wealth of iron and coal?

GOLD AND SILVER, p. 40.

Sections 75—81.

1. How many distinct gold-fields has the United States?
2. Describe their situation and extent.
3. What is said by geology in respect to the "auriferous veins" of California?
4. Where is gold found, and where silver?
5. Describe the finding of gold and the effect upon the country.

6. Explain with what difficulties the gold-bearing quartz is obtained, and the gold extracted.
7. What is hoped from science in facilitating the extracting of gold?
8. What is said of the richness of the mines?
9. Explain the mining industry of Idaho.
10. Describe the isolated deposits of War Eagle Mountain.
11. Mention in what way Colorado is rich.
12. What is said of mines at Leadville?
13. Give a summary of the gold-mines of Montana, Wyoming, Black Hills, New Mexico, and Arizona.

Sections 82—85.

1. In what respect does Nevada stand preëminent?
2. Describe the Comstock lode and its mining.
3. The Sutro Tunnel. What its purpose and probable effect?
4. Name the estimated area of the gold and silver fields of the United States.
5. Name the minor metals, and tell where found.

PETROLEUM, p. 47.

Sections 86—89.

1. Specify the theories in respect to the origin of petroleum.
2. What do geologists say on the subject?
3. Give the first theory, the second, and the difficulties in adopting either.
4. Describe the three classes of oils as to their characteristics.
5. What is the position of the strata of rocks in which petroleum is found?
6. What are the effects when the auger penetrates the reservoir?
7. Name the regions most productive of oil.
8. Give the amount of area that geology estimates to be oil-producing.

LEAD AND COPPER, p. 50.

Sections 90—92.

1. Name the sections of the Union where lead is found in limited quantities.
2. Name the three States having a large area of lead-ore.
3. What is the extent of the area? Where was the ore frequently found?
4. Describe the lead-mines at Grandley, Missouri.
5. Where is copper found most abundantly east of the Mississippi?
6. In what State and Territory west of that river?
7. Where is located the great copper-field of the Union?
8. Name the difficulties of mining pure copper.
9. Describe Isle Royale and its mines.
10. What ores are abundant on the north shore of Lake Superior?

QUICKSILVER, GRAPHITE, SLATE, p. 53.

Sections 93—97.

1. Describe the location of the New Almaden mine.
2. Why is quicksilver used for extracting gold and silver?
3. Describe the ore and the working of the New Almaden mine.
4. Explain how the metal is extracted.
5. What is said of the production and wastage of quicksilver?
6. In what other countries is quicksilver found?
7. What is graphite or plumbago?
8. Where is it found in the United States?
9. Where in the Old World is it found most abundantly?
10. Describe the mine at Ticonderoga.
11. How many kinds are found here and for what purposes used?
12. For what other purposes is plumbago used?
13. What is said of the native pureness of the graphite found here?
14. What monopoly has Florida?
15. Name the three States having rich slate-quarries.
16. For what purpose are the slates of the first named specially adapted?
17. Name the uses to which slate has been applied.
18. Which of these uses is the most interesting?
19. How are slate-pencils made?

GRANITE, SANDSTONE, MARBLE, p. 57.

Sections 98—102.

1. Name where the best granite is found abundantly.
2. For what class of buildings is it much used?
3. What is said of the Granite State?
4. How is the granite dressed and usually transported?
5. Name the places famed for brown-stone quarries.
6. For what is it mostly used?
7. Where are large deposits of coarse marble found, and how used?
8. Describe the Lockport gray limestone.
9. Why is it used for building purposes and ornamentation?
10. Where are many quarries of drab sandstone?
11. Why is it used for trimmings?
12. Describe the marble belt of Vermont. Give its characteristics?
13. What is said of the uses to which it is applied?
14. Explain how it is sometimes quarried.
15. Where is black marble found?

GYPSUM, SALT, MARL, AND PHOSPHATES, p. 60.

Sections 103, 104.

1. Gypsum—where found both coarse and fine?
2. Near what springs are *whetstones* quarried?

3. For what other purpose is this stone used?
4. Name where kaolin is found. For what purpose used?
5. Where is *mica* obtained in large quantities?
6. Name where *sand* for making glass is found.
7. Mention the principal places in the Union where salt is obtained.
8. Describe the wells in the vicinity of Syracuse, New York.
9. What is said of the wells in the Saginaw Basin, Michigan?
10. State the character of the salt-springs in Kansas.
11. What facilities has West Virginia for making salt?
12. Where else is salt found in abundance?

MARL AND PHOSPHATES; MINERAL SPRINGS, p. 62.

Sections 105—109.

1. The elements of what stone penetrate the soil?
2. Describe the marl of New Jersey; for what crops suitable?
3. What are the properties of the marl and phosphates of South Carolina?
4. What the extent and richness of these beds?
5. Remains of what animals are imbedded in these deposits?
6. Are there other deposits of marl in the Union?
7. What is said of the mineral springs of New England?
8. Name the various mineral springs of New York State; their properties.
9. Give a full account of Saratoga Springs.
10. Describe the springs of the two Virginias.
11. What is said of the hot springs of Arkansas?
12. Give an account of other medicinal springs.

HEALTH RESORTS, p. 65.

Sections 110—114.

1. What is said of the advantages of health resorts?
2. What good effect derived from them incidentally?
3. Name the health resorts on the Atlantic slope.
4. Describe Aiken; what the characteristics of its climate?
5. What is said of the altitude of the village and the balsamic odors?
6. Describe the location of Asheville, North Carolina; give its altitude.
7. What is said of its climate?
8. State at length the peculiarities of the climate of Florida.
9. Why is the temperature so equable?
10. What are the inducements for invalids to sojourn in Florida?
11. Why should invalids seek Minnesota and the adjacent region?
12. What effect is produced by this dry and cold atmosphere?
13. Why is a portion of Colorado a health resort?
14. Explain why the climate is dry at certain seasons.
15. What is said of the sunshine and altitude?

16. How does the climate compare with that of Florida?
17. What is said of southern California as a health resort?
18. Explain how Santa Barbara and vicinity are protected.
19. Describe the sites for residences.
20. Give a summary of the advantages of this region as a health resort.

SOIL AND RAINFALL, p. 69.

Sections 115—120.

1. In what manner should this *resource* be valued?
2. State the geographical position of the United States.
3. What is said of the soil and its capability of cultivation?
4. Explain as to the uniformity and abundance of rain.
5. Compare the rainfall on the Atlantic slope with that in the Mississippi Valley.
6. Explain the "discrimination."
7. What is said of the annual average rainfall of Europe?
8. Give an account of the rainfall on the Pacific slope.
9. Explain why the United States is a land of pure springs and crystal brooks.

Sections 121—124.

1. What is said of an ocean-current?
2. State the effect of the Gulf Stream on western Europe.
3. Explain how the vapor off the current benefits the Great Valley.
4. State the theory and the pledges given.
5. Give an account of the Western prairies and of the buffalo-grass.
6. In what two respects do its roots affect the soil?
7. What is said of the rainfall on the one hundredth meridian west?
8. Explain the change of climate going on and the result.
9. What is said of irrigation? in what regions is it used?
10. State the effect of the water on the alkali of the soil?
11. How does the width of the United States compare with that of Asia and Europe combined?
12. What advantage does the United States derive from the two oceans?
13. What is said of dry areas of territory?

CLIMATE, p. 75.

Sections 125—127.

1. How has the climate of the United States been described?
2. Explain the difference of climate between the Atlantic and Pacific slopes.
3. Give a summary of the influences that modify the climate of the Great Valley.
4. What is said of the temperature on the Saskatchewan?
5. Compare it with that in certain places in the Union.

6. Compare the average temperature at Fort Benton with that of the places mentioned.
7. Explain in what way the temperature on the Pacific slope is modified.
8. What is said in respect to flowers blooming at the straits of Fuca?
9. Name the comparisons between Sitka and Washington, Puget Sound and Norfolk.
10. Why should the Northwest of the United States become densely populated?

PRODUCTS OF THE SOIL, p. 78.

Sections 128—132.

1. Explain the character of the soil of the Union.
2. How do its products compare with other sources of wealth?
3. Give a summary and outline of the wheat belt.
4. Explain fully why a famine is not likely to occur in the United States.
5. What is said of two crops a year?
6. Describe the area producing Indian corn.
7. What countries can we supply with cotton?
8. Why is cotton more available as an article of commerce than the cereals?
9. Where is rice cultivated? Where sugar-cane?
10. What is said of tobacco?
11. Give a summary of the minor grains. In what region cultivated?
12. Give an account of the vegetables raised, both North and South.

GRASSES, p. 80.

Sections 133—135.

1. Mention the advantages arising from the native grasses of the United States.
2. Name the region in which specially these grasses feed cattle.
3. What States are prominent for their herds of fine cattle?
4. Describe the belt of native and cultivated grasses; their properties.
5. What are the two principal products of the dairy?
6. How do these in value compare with some other products?
7. Explain the improvements in manufacturing cheese and butter.
8. What two classes of animals are raised to advantage?
9. In what way is Indian corn utilized?
10. Explain the continuous improvements in the qualities of domestic animals.
11. In what class of animals is this specially noticeable?

FRUITS, p. 82.

Sections 136—142.

1. Name the value of fruits.
2. Describe the apple-producing belt.

3. Give a summary of its excellences, and the value of the crop.
4. What is said of the peach? Its producing belt?
5. Explain how it is preserved to advantage.
6. Give the value of the crop, and that of the pear.
7. What is said of the vine and its value?
8. In what two sections is wine made in large quantities?
9. Give an account of the small fruits cultivated in Florida.
10. Describe its orange-groves; their beauty; the excellence of the fruits.
11. Name the other fruits grown in this State.
12. What cities are supplied with these fruits?
13. Whence do the cities of the Great Valley obtain oranges?
14. What is said of the early small fruits of Virginia and Delaware?
15. Name the center of this trade in small fruits.
16. How is this resource to be reckoned?
17. Name the fruits of California. Describe their excellences.
18. What is said of the olive, the orange, and the English walnut?
19. Tell of the success in cultivating the grape, and wine-making.
20. Why does the sugar-beet grow so finely in this State?
21. What striking feature is there in the cultivation of fruits?
22. Describe the process by which fruits are improved.
23. What is the estimated value of the fruit crop?

FORESTS, p. 87.

Sections 143—145.

1. Describe the forests of Maine. For what used?
2. Give an account of the forests around the White Mountains; also in the Adirondacks and the Catskills.
3. What is said of the forests extending on both sides of the Alleghanies?
4. State the value of the pine-forests of the Carolinas and Georgia.
5. Wherein is the value of the cedars of Florida?
6. Give an account of the forests of Michigan, of the Rocky Mountains, of the Cascades, and of the Coast Range.
7. Describe the forests of Oregon, of Washington Territory, and of Alaska.
8. What is said of the efforts to preserve and plant forests?

RESOURCES OF FRESH WATERS AND OF THE SEA, p. 89.

Sections 146—151.

1. What is stated in relation to the value of the fisheries of the Great Lakes?
2. Why is ice a necessity? What blessings does it confer on the cities?
3. What effect does ice have on food-supplies of fish and meats?
4. Name the extent of the ocean laid under contribution for food-supplies.

5. Mention the fisheries of different kinds along the Atlantic coast.
6. What is said of the "shoals" and "banks"?
7. State the amount of fish caught in a single year around Nova Scotia.
8. Give an account of the fishing industry of Gloucester, Massachusetts.
9. Name the uses to which the menhaden are put.
10. Explain how their flesh has been utilized.
11. Describe the fishery at the mouth of the Chowan, and the result.
12. Give the result of fish-culture. To what is it likely to lead?

OYSTERS, p. 93.

Sections 152—155.

1. Describe the great storehouse of oysters in Chesapeake Bay.
2. Explain how they are transported and where planted.
3. What the value of this trade in New York City?
4. State the amount of oysters brought yearly from the Bay to Fair Haven.
5. Explain how oysters are put up for use.
6. What two cities on the Chesapeake are extensively engaged in this trade?
7. Baltimore exports raw oysters to what countries?
8. Why is the flavor of the oysters of the Chesapeake so fine?
9. What is said of the canning and pickling industry of Baltimore?
10. State what is said of the clam-beds. Where found?
11. Mention the uses of this shell-fish.
12. Give a summary of what is said of the lobster.
13. Describe fully the fisheries in Puget Sound, and off the straits of Fuca.
14. What is said of the fish found in the waters along the southern coast of Alaska?

SALMON, FUR-BEARING SEALS, WILD GAME, p. 97.

Sections 156—161.

1. Why do the salmon frequent the Columbia?
2. Explain how these fish are caught.
3. Describe the process of cooking and canning salmon.
4. Name the amount prepared in different ways for market.
5. What is said of the demand for these fish thus prepared?
6. Where else are salmon found on this coast?
7. Give an account of the fur-bearing seals. Where found?
8. What are the regulations of the United States Government in respect to their capture?
9. How many are allowed to be taken yearly?
10. Of what birds consist the wild game of the Chesapeake?

11. Describe the habits of this wild game in their haunts.
12. What is said of the canvas-back as to their food and flavor?
13. Where is the principal depot of this traffic?
14. Give an account of the migrations of these birds to and from the Yukon.
15. Describe their habits in respect to raising their young.
16. What is said of their resting-places?

HOMESTEAD LAW AND TIMBER ACT, p. 102.

Sections 162—172.

1. Why give an account of the Homestead Law?
2. Give the provisions of the law.
3. The object of the Timber Act.
4. What its provisions?
5. Give the results of the two laws.
6. What is said of railway grants?
7. What is stated of the school fund?
8. State the price of lands inside and outside railway grants.
9. What is said of the three main railroads?
10. What of the shorter roads?
11. How and where are homes purchased?
12. Character of the settlers?
13. What will they gain in the end?
14. To whom does the welcome extend?
15. Explain why this law is the poor man's friend.
16. What caution is given?

THE END.

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